Aalto University
School of Engineering

Islam Ibrahim

European Real Estate Companies' Reaction to Brexit: An Event Study

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Supervisor: Assistant Professor Heidi Falkenbach

Aalto University
School of Engineering

Aalto University, P.O. BOX 11000,
00076 AALTO
www.aalto.fi

Abstract of master's thesis

Author Islam Ibrahim		
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Abstract

Brexit is unequivocally expected to have economic repercussions and send ripples across Europe. The implications are expected to reflect on the performance of the various markets through transmission channels. Those transmission channels could be concluded in the fundamental macroeconomic indicators. The real estate investment is a substantial prominent market that is expected to be affected by the implications of Brexit and sensitively react to the possible transmission channels.

The research investigates the European real estate companies' reaction towards those transmission channels and their implications. It is hypothesized that companies with higher exposure to Brexit's effects, and accordingly, channels of transmission, should exhibit a more pronounced reaction. The empirical examination employs an event study framework augmented by multivariate regression analysis, where significant Abnormal Returns (ARs) and Cumulative Abnormal Returns (CARS) were used as leading indicators for real estate market reaction. The exposure is proxied by the magnitude of the company's direct investment in the markets which are prone to the implications. Brexit was proxied by the Referendum event that took place on 23 of June 2016. Fifty-two listed real estate companies, from 9 different countries were sampled.

The results suggest that exposure to the forecasted negative repercussions has a significant adverse impact on the real estate companies' returns, while exposure to possible positive consequence has a significant positive and negative reaction. The findings, on the one hand, brace the Efficient Market Hypothesis. It displays the market's ability to swiftly price-in expected negative and positive repercussions. On the other hand, it vividly demonstrates the impact of Brexit on the real estate market.

Keywords European real estate companies, Brexit, event study, macroeconomic effects, listed real estate, seemingly unrelated regression (SUR), Efficient Market hypothesis (EMH)

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1 Introduction

1.1. Background

In a historic referendum, the majority of the United Kingdom (UK) citizens set their country on the path to leave the European Union (EU), in an event known as Brexit. In 2013, the Prime Minister of UK, David Cameron pledged an in/out referendum in case the Conservative Party win the general election. On 23 June 2016, the referendum was held putting forward the question "Should the United Kingdom remain a member of the European Union or leave the European Union?" with 71,8% participation rate and a marginal difference in results between remain and leave, 48,1% and 51,9% respectively, those who are in favor of leaving won. England voted for Brexit, by 53,4% to 46,6%, Wales as well voted for Brexit, with Leave gaining 52,5% of the votes and Remain 47,5%. Scotland and Northern Ireland both favored staying in the EU. Scotland favored Remain by 62% to 38%, while 55,8% in Northern Ireland voted Remain and 44.2% Leave. The result of the Referendum was proceeded by many related events, news, announcements, and actions to move forward with the leaving decision. One of these prominent events is triggering Article 50 of the Lisbon Treaty. On 29 March 2017, Article 50, that gives any EU member state the right to unilaterally leave the European Union (Weale, 2018), was invoked. The triggering of that Article means that UK has to start withdrawal negotiations for two years, after which, it should cease to be an EU member (Sampson, 2017), and enter a transitional period that lasts until the 31 December 2020.

Since Article 50 triggering, UK government has been engaging in negotiations and debates both internally, with the parliament, and externally with the EU to set the features of its future ties with the EU and the rest of the world as a stand-alone State. The non-consensus between the different parties forced the UK to seek, few times, further extensions to Article 50 processes from the EU. On 10 April 2019 at the meeting of the European Council, the EU agreed to extend Article 50 until the 31 October 2019. Accordingly, up to the point of conducting this research, the future of Brexit, and how it is going to materialize is still unknown. For detailed chronological events, see Walker (2019).

It could be fairly adjudged that Brexit in sum, is an unprecedented event. Similar events could be the departure of Algeria after gaining its independence from France in 1962, or Greenland after being autonomous Danish territory in 1985, see Patel (2018). However, the UK is the first large, powerful Member state with roots of relations between the other Member States to withdraw (Martill & Staiger, 2018). UK is the second large economy, third most populous, and a significant net contributor Member in the EU budget. EU as a bloc is the largest trading partner for the UK. In 2016, the year of the referendum, the EU accounted for nearly 45% of the UK's exports and 55 % of its imports. Accordingly, the departure will send ripples across the continent, having different economic entities and markets to react.

Such market reaction would be sourced from expected consequences. Fama (1970) argued that a market reaction is not attributed to a mere event but to the foreseen implications of that event. Like any divorce, the envisaged departure of the UK from the EU is not expected to come cheap, and myriad consequences would be anticipated.

The prominent economic concern is for the United Kingdom to lose full access to the single market as a Member State Full Access to the single market means having the privilege of the four movement-freedoms; movement of goods, services, capital and labor, a privilege that is considered "central tenet of the European Union" (Van Reenen, 2016). Such privileges strengthened the economic cooperation between the UK and the EU. It motivated trading channels, inward foreign investment, and labor market growth. The free capital movement /Passporting-right, per se, helped in making UK the center of the single market financial services (Wyman, 2016; Sampson, 2017), where investors used UK as a platform and gateway for accessing the EU financial market. Almost three-quarters of foreign investors cite access to the European market as a reason for their investment in the UK (HM-Treasury, 2016). The free movement of goods and services increased trade in goods by 48% and services by 84% (Felbermayr, et al., 2018). Nearly 40% of the UK's service export goes to EU (Lowe, 2018). Studies suggest that the UK's GDP gained 10% from being a Member State, where foreign direct investment alone is claimed to increase GDP by 2,25% (Crafts, 2016). Moreover, the UK's GDP has doubled since joining the Union in 1973 (OECD, 2016). Based on that, losing such a privilege would have its repercussions on economics performance. The magnitude of those repercussions heavily hinges on the shape of the UK-EU economic relation post-Brexit.

Considering the ongoing debates on the possible nature of this relation, three prominent scenarios could be forecasted. 1) A "soft" Brexit, meaning that UK could secure a deal that allows for preserving access to the Single Market through Free Trade Agreement or the European Economic Area (EEA), following the Norway, Iceland and Liechtenstein example. 2) A "hard" Brexit, where UK-EU economic relation will follow the World Trade Organization (WTO) terms, meaning that most-favored-nation tariffs will be imposed (Van Reenen, 2016). 3) Another option is an exclusive bilateral agreement between the UK and EU that might lead to a particular relation to consider the four decades of deep, entangled UK-EU relationship in the Single Market. Such a special relationship could resemble that of the European Free Trade Association (EFTA), following Switzerland or Customs union following Turkey, (see (Sampson, 2017; Martill & Staiger, 2018). The adoption of any of those scenarios, however, will affect the economic performance of the UK. The extent of the effect would essentially evolve from an imposed limitation to access the Single Market or a complete block from such an advantage. Consequently, a rise in trading costs for both goods and services could materialize, demotivating trading volumes.

Despite the challenges and the no-consensuses-state, some contemporaneous papers have been published to lend credence to the macroeconomic consequences. Those studies mainly put forward their findings in GDP terms relative to each of the anticipated scenarios (HM-Treasury, 2016; OECD, 2016; IMF, 2018). The most rigorous research has been carried out by (HM-Treasury, 2016). The study proposed that in the short term, the GDP would fall between –3,6% to – 6,0%. In principle, A fall in the GDP was attributed to the state of uncertainty that the UK economy will experience and the prolonged period it will take to reach alternative economic agreements with the EU and the rest of the countries. Such uncertainty would decrease investor confidence, demotivate spending, and increase the risk premia (OECD, 2016). On the long-term, the GDP was estimated to fall by –3,8% to –7,5% (HM-Treasury, 2016) or by –2,7 % to –7,7 % (OECD, 2016). Those estimations are concluded by incorporating the potential effect from higher trade barriers, lower migration, and

reduced inward investments. Based on that, it could be clearly induced that a negative impact is expected on the macroeconomy regardless of the scenario; “soft” or “hard” Brexit, the only difference could be in the magnitude of the impact.

As to most of the economic sectors, Brexit consequences are expected to descend to the real estate market through various transmission channels. On the short-term, the real estate market, especially the securitized one, is expected to react to the shortfalls of uncertainty. Uncertainty would increase the risk premium and accordingly pressure the real estate asset prices. Also, it could limit credit access, increasing the cost of debt and in turn, decrease the real estate prices. On the long-term, however, channels of transmission might be expanded. A fall in GDP, per se, could have various routes to hit the real estate market due to its close interdependence with almost all other macroeconomic factors. Several studies have been conducted to examine the correlation between the GDP and the real estate market performance (Case, et al., 2000; Edelstein, et al., 2011; Bełej & Cellmer, 2014; Delfim & Hoesli, 2016). The findings of those studies present a strong positive correlation between GDP and real estate returns on so many levels, local, regional, and international. A weak GDP performance is a sign of slow economic growth. Such a sign might demotivate foreign direct Investment (FDI) or even lead to a gradual withdrawal. That implication could unfavorably lead to drainage in liquidity channels, thus increasing the risk premium and consequently, the capital rate, forcing the real estate price to take a downturn (McAllister & Nanda, 2015; Oikarinen & Falkenbach, 2017).

Interest rate and unemployment could, as well, exhibit a vivid channel of transmission. Real estate is a sizable investment. It relies heavily on credit channels and available gearing levels. An increase in interest rate could directly increase the risk-free rate and volatility, which will be directly priced in the asset value. It would lower the price by boosting the market capitalization rate, given that the market cap rate = risk-free rate + risk premium – growth rate (Oikarinen & Falkenbach, 2017). Thus, the interest rate is negatively linked to real estate returns (Ling & Naranjo, 1997; Bełej & Cellmer, 2014; Delfim & Hoesli, 2016). In the same context, a rise in the unemployment rate would turn to a lower income, fall in demand, and ultimately hinders rental growth. Hence, it would negatively affect the market profitability and growth. Accordingly, several studies found a correlation between the unemployment rate and property returns (Lorenz & Trück, 2008; Bełej & Cellmer, 2014).

Currency fluctuation and Inflation could also go hand in hand as transmission channels. Inflation has almost tripled in the UK since the referendum, and the Sterling lost about 12% of its value against the Euro (ONS, 2019). Currency deprecation would lead to inflation. A shock in inflation could lead to a diminished real growth rate or an increased interest rate (risk-free rate), which in turn decrease asset returns and eventually, property's value. Delfim & Hoesli (2016) examined both expected and unexpected inflation for the period between 2001 and 2014 for different investments vehicles. In their results, listed real estate showed an adverse reaction to the expected inflation yet positive one to the unexpected inflation contrasting the direct and non-listed real estate, which presented the opposite response. Pavlov et al. (2015) found a significant negative correlation between securitized real estate returns and currency fluctuations, similar to the findings by (Vassalou, 2000).

In sum, Brexit is expected to disturb the performance of the macroeconomic indicators, which in turn, will reflect on the real estate market performance, giving the role of the macroeconomic variables as real estate returns' drivers. Accordingly, it is of interest to investigate the real estate market response to Brexit effects and its possible implications on these macroeconomic indicators.

1.2. Research Aim and Scope

The research will be an initial attempt to understand the effect of Brexit on the real estate market. It aims to examine the sensitivity of real estate companies to the consequences of Brexit. Moreover, to test the ability of their performance (returns) to swiftly reflect the news and information that would impact the return drivers.

The scope will cover European real estate companies, those that are incorporated in a European country. Those companies are mostly expected to experience the reaction and accordingly aid in examing the effect. The study will cover only the referendum event. The referendum event is the most prominent among the other Brexit events so far. More importantly, it is assumed that the referendum results were hard to expect. The evidence for that assumption is the nearly fifty-fifty voting result. Thus, the results are conjectured to shock the market and force it to react. That conjecture is crucial for the validity of the event study methodology employed in this research.

1.3. Research Question and Hypothesis

A reaction from the real estate companies is anticipated to be relative to news and information that would shed light on the shape of UK-EU relation post-Brexit and the possible repercussions of that relation. Additionally, considering that the UK market is the primary source of those transmission channels, the level of exposure to that market should be correlated to the magnitude of the reaction. Thus, the degree of exposure could constitute an asymmetry in the response between different companies.

Research Question

- Do Real Estate companies react asymmetrically to Brexit events?
  - Do Real Estate companies react to Brexit events?
  - Do Real Estate companies with higher exposure experience a more pronounced reaction?

Research Hypothesis

The research hypothesis is that real estate companies would react to possible Brexit consequences. Moreover, those with higher market exposure to, and more entangled economic ties with the markets that reflect those consequences would experience a more pronounced reaction. In order to examine that reaction, an event study framework will be employed.

The event study has been widely used in the literature to test the market or even a single firm reaction to a specific relevant-event. The event study evolves from the Efficient Market Hypothesis (EMH) (Fama, et al., 1969; Fama, 1970). The EMH extends the random-walk hypothesis, which, in principle, claim that future performance of returns is independent of past performance. It implies that the market has "no memory" of the

past to predict the future as delineated by (Malkiel, 2003). Fama (1970) proposed that for a capital market to be efficient, it has to reflect all the available information comprehensively. His hypothesis suggested three forms of efficiency, "*trichotomy* as put by (Schwartz, 1970). First, "*weak"* form where market returns reflect historical information on prices. Second, "*semi-strong"* form where market returns reflect both the historical data (prices) and all available public information. Third, the "*strong"* form where the returns reflect the previous categories of information, in addition to, exclusive information known only by insiders, floor traders or privileged group of investors. Although both "*weak"* and "*strong"* form of market efficiencies are cardinal, the event study framework could be more concerned with the "*semi-strong"* form. It implies that market returns would be adjusted to the available public "new" information.

1.4. Research Contribution and Motivation

Putting forward the unprecedented character of Brexit (Patel, 2018), no previous event studies covered such an event The research will contribute to the scarce literature on market reactions to such a unique event. It will add to the contemporaneous reviews on Brexit effects and to the literature that is concerned with the impacts of macroeconomic factors on real estate returns and the possible transmission channels. Moreover, it will pave the way for future studies that aim to investigate other Brexit events, testing for reversal, or more aggressive reactions.

The research is mainly motivated by the substantial magnitude of investments that hangs on the value of the real estate assets, in addition to, the significant share of the European Union real estate market in contrast to all Europe. The Global real estate market reached over USD 30 trillion in 2019, coming from USD 27,5 trillion in 2016. The share of total Europe (Developed and Emerging) is approximately USD 8.9 trillion, of which over 90% belongs to the European Union Market (EPRA, 2019).

1.5. Research Structure

The following, Chapter 2 presents an exhaustive overview of the possible repercussion of Brexit on the macroeconomy of the UK and investigates the possible transmission channels between those repercussions and the real estate market performance. Then, Chapter 3 is a literature review on relevant events studies will be presented covering the theoretical framework for such studies. Chapter 4 describes the methodology, estimation procedures, and the built-equations employed in the research, in addition to the data retrieved and utilized. The results of the empirical study of the research will be exhibited in Chapter 5. Finally, Chapter 6 discuss those empirical findings and the conclusion in light of the outlined literature, in addition to, the evaluation of the study, and possible future research.

2 Brexit and Macroeconomic Repercussions

It is of the essence to understand the possible repercussions of Brexit on the macroeconomics and the impact that could be cascaded down to the microeconomics of the real estate sector. The literature review will cover the expected implications of such an event on the macroeconomy. Then the possible transmission channel to the real estate sector by examining the sensitivity of the real estate sector to the macroeconomic indicators. Finally, it will review the literature on the methodology selected to investigate the reaction of the real estate companies to Brexit.

The significance of Brexit descends from the expected implications on the macroeconomics that such an event could present. Those implications, in principle, are foregoing the EU Membership and the subsequent economic gains that the UK is bestowed by being a Member State. UK has a rooted economic tie with the EU since it joined in 1973. To put it in context, the EU is the leading trading partner of the UK. In 2016 the EU accounted for nearly 45% of UK exports and 55 % of its imports (ONS, 2019), see table 1. Exports to EU countries account for about 12% of UK GDP, and since being a Member State, the UK GDP has doubled (OECD, 2016). The EU Membership led to an increase in trading cooperation, where it increased trade in goods by 48% and services by 84% (Felbermayr, et al., 2018). Although the UK's balance of trade in goods is negative with the EU, the trade in services is often showing a surplus (ONS, 2019). UK has been the gateway access and the financial services platform for the rest of the EU Member States (Wyman, 2016; HM-Treasury, 2016; Sampson, 2017). A substantial share of the foreign direct investment to the UK comes from the EU, over the past decade the inward FDI has been between 0.4 to 11 percent of UK's GDP (IMF, 2018). It is estimated that being a member of the EU has increased FDI inflows in the UK by about 28% (Bruno, et al., 2016; Dhingra, et al., 2017). Additionally, the UK accounts for the largest share of FDI inflows into the EU (OECD, 2016).

Table 1 *UK Imports and Exports in 2016*

UK trade with the EU			
	Goods	142,705	
	Services	104,034	
Exports			246,739
	Goods	237,067	
	Services	76,966	
Imports			314,033
UK trade with the rest of the World			
Exports			310,222
Imports			273,815

Source ONS, 2019

The economic integration and prosperity that the UK witnessed after joining the EU were mainly attributed to its full access to the Single Market, a cornerstone upon which the European Union was established (Van Reenen, 2016). The Single Market grants the Member States free movement of goods, capital, and labor. In other words, it considerably alleviates the trading and investment costs and encourages economic

growth. From an economic perspective, exiting the EU means forgoing the privilege of full access to the Single Market and seeking other alternatives. Losing such a right could have a multitude of negative results. None of the debated-alternatives could fully compensate for those negative implications. Accordingly, Brexit could transcend to a shift in the UK's economic landscape. It would heighten trading barriers, tighten capital movements, and discourage economic immigrations.

The repercussion of Brexit would transmit in several channels that have both time and extent dimensions. The extent of the consequence hinges on the type of economic agreement that could be concluded between EU-UK post-Brexit. Several scenarios could be anticipated, see table 2. The closest scenario to grant UK similar access to the Single Market is joining the European Economic Association (EEA). That scenario will obligate the UK to contribute to the EU budget and allow for free movement of labor. Those obligations particularly contradict with the principles upon which the leave campaign voted and won. The aggressive scenario would be building UK-EU relations on the World Trade Organization (WTO) terms, which means the most favored nation tariffs would be followed. Such a scenario would substantially increase the trading costs and completely block the UK from Single Market privileges. An intermediate scenario would be seeking a Free Trade Agreement (FTA). However, such agreements could take a decade to be concluded like the case of Canada (OECD, 2016). Accordingly, none of the scenarios would replicate the state of the UK being a Member State.

Table 2 *Possible UK-EU withdrawal agreements*

Agreement type	Examples	Features
European Economic Union	Iceland, Norway, and Liechtenstein	• Contributions to the EU budget. • Free movement of goods, capital, services, and people. • Outside the EU Customs Union. • Very limited influence on regulation.
European Free Trade Association (EFTA)	Switzerland	• Contributions to the EU budget. • Requires trade agreements with individual EU countries and across industry sectors. • No "passporting" rights for banks. • Outside the EU Customs Union. • Very limited influence on regulation.
Customs union	Turkey	• Tariff-free access to most of the EU Single Market, except for financial services. • Adoption of EU external tariffs for non-EU trade. • Very limited influence on regulation.
Free Trade Agreement (FTA)	Canada	• Mostly tariff-free Single Market access, but compliance needed with EU standards and product regulations. • No full access for services and no automatic "passporting" rights for banks.

World Trade Organization - Most-Favored Nation (MFN)	Russia, Brazil	• Trade with the EU subject to the EU's common external tariff.

Source: OECD compilation

Several studies have been conducted by economic organizations to paint the expected outcomes based on the possible scenarios (OECD, 2016; HM-Treasury, 2016; IMF, 2018), in addition to, number of academic researchers (Bruno, et al., 2016; Van Reenen, 2016; Dhingra, et al., 2017; Sampson, 2017). All of those studies concluded that, in all scenarios, Brexit would reversely impact the UK's GDP, only the magnitude of the impact will depend on the materialized scenario. The implications are primarily higher trading barriers, a reduction in foreign direct investments, and a demotivation for economic immigration and labor growth.

There are short-term effects and long-term repercussions for Brexit. On the short-term, an analysis by HM treasury (2016) categorized three main effects. "Transition effect" results from the UK being less open to trade and investment. "Uncertainty effect" that emerges from the vagueness about the EU-UK economic relation post-Brexit and the wide-range of potential scenarios. "Financial conditions' effect" the volatility that might associate the financial market due to weaker confidence. Such effects would increase the risk premium and subsequently cost of debt reflecting on asset pricing. It would trigger a cut in spending, employment, and the appetite to invest. Those effects will ultimately reflect on the UK macroeconomics. (HM-Treasury, 2016) employed a vector auto-regression (VAR) Equation to identify the impact of the increased uncertainty on the overall economic activity, see table 3.

Table 3 *Brexit Short-term Impacts*

Macroeconomic Indicator	Effect
GDP	-3.6 to –6.0
CPI Inflation	+2.3 to +2.7
Unemployment rate	+1.6 to +2.4
House prices	-10% to –18%
Sterling exchange rate	-12% to -15%

Source: HM Treasury, 2016

On the long-term see table 4, the consequence will be more aggressive, but would substantially depend on the shape on the UK-EU relation post-Brexit. In general, losing access to the Single Market would lead to a higher trading cost. Trading costs are sourced from both tariffs barriers (Customs) and non-tariffs barriers (border control, rules-of-origin checks, and regulation on products standards). It will also lead to a tighter capital movement and immigration policy. Higher trading costs and tighter capital movements would reflect in a decrease in the foreign direct investment (OECD, 2016). The access to the Single Market was a prominent reason for the UK's attractiveness for FDI. Almost three-quarters of foreign investors cite access to the European market as a reason for their investment in the UK (HM-Treasury, 2016). The annual value of inward FDI has been between 0.4 to 11 percent of UK GDP over the past ten years, and a significant share of it comes from the EU (IMF, 2018).

On the other hand, restricted immigration would lower labor force growth and could cause skilled brains drainage, hindering technical innovation. Economic immigration

accounts for one-half of the UK's GDP growth since 2005 (OECD, 2016). All those channels are expected to ultimately have repercussions on the GDP, see table 4. None of the possible scenarios could completely block those repercussions. Different studies show a close estimation. The least estimated fall in the GDP is 2,6% (IMF, 2018), it is estimated using a standard multi-country and multi-sector computable general equilibrium model. That fall significantly outweighs the 0,35% gain when UK refrain from contributing to the EU budget after exiting the Union.

Table 4 *Brexit long-term repercussions*

Time span	Scenario	GDP (%)	Transmission channels						
			Risk premia	Confidence	Trade	FDI	Skills	Immi-gration	Dereg-ulation
2020		-3.3	•	•	•			•	
2030	Optimistic	-2.7			•	•	•	•	•
	Central	-5.1			•	•	•	•	•
	Pessimistic	-7.7			•	•	•	•	

The change in GDP is relative to No-Brexit scenario

Source OECD calculations

In the same regard, (Portes & Forte, 2016) tackled the impact on GDP from the labor growth perspective. Their study focused on immigration reduction consequences. As the extent of Brexit is still vague, their study relied on the concept of reversal. The reversal means relying on the estimates of the direct impact of immigration-free-movement and how Brexit could reverse that impact. Two scenarios where employed 50%, and an extreme 100% reversal by the year 2020, in light of different Brexit scenarios. The first scenario, the "central scenario," as named by the authors, estimated the GDP to fall between 0,63% and 1,19%. While for the extreme scenario, it is expected to fall between 0,92% up to nearly 1,78%. The fall would be caused by a decrease in employment, labor force, productivity, and ultimately, GDP.

On a more extended level, Bruno et al. (2016) investigated the effect of Brexit on the foreign direct investment (FDI) levels. In other words, how EU membership affects the inflows of FDI. Their study sourced bilateral FDI data on 34 OECD countries spanning 28 years from 1985-2013 and deployed the structural gravity model. The results were robust and showed that EU membership on average increases FDI by 28%. It estimates a 22% reduction in the UK's FDI had Brexit materialize. FDI is a significant contributor to national productivity and wage. It brings technological advantages and managerial best practices, and as mentioned before, a reduction in FDI could negatively influence the GDP.

The results of the studies mentioned above manifest the UK as an unfavorable prospect for future investments after Brexit. Accordingly, based on a study carried by Bruegel, 30% of the wholesale banking in Europe, with 10,000 banking position will relocate from London to the monetary union of Europe (Sapir, et al., 2017). The study suggests that Germany and France are prominent alternatives. Also, (Schelkle, 2018) proposed that if Brexit materializes, it is likely that investment institutions will re-allocate from the UK to a different EU center, such as Frankfurt or Paris to preserve the access to the Single Market. The choice of France and Germany in contrast to the UK comes from their active role in maintaining the unity of the remaining EU members after Brexit was initiated, see (Paterson, 2018) and (Drake, 2018). (Knight-Frank, 2018) investigated the

re-allocations and found that Ireland attracted the most significant number of re-allocations with nearly 25% of the total re-allocation recorded by Knight-Frank, followed by Luxembourg, 20% then Germany and France by approximately 14,5% and 12% respectively.

Evidentially Brexit will have implications which will ultimately affect various markets in both short and long terms. The long-term consequences would result from a disruption in the macroeconomic performance while the short-term effects are attributed to forecasting and uncertainty. Consequently, market reaction is immanent to price-in those effects.

3 Transmission Channels

It is hard to interpret the direct effect of Brexit on the real estate market as the event is not directly targeting that specific market. But it could be analyzed indirectly through possible transmission channels. The channels that would convey the effects to the real estate return drivers. As demonstrated, Brexit will have repercussion on the macroeconomic variables (Van Reenen, 2016; Dhingra, et al., 2017; Felbermayr, et al., 2018). Those variables, per se, are expected to act as direct transmission channels. Several studies examined the effect of the macroeconomic variables on the real estate sector, where it has been concluded that those variables act as return drivers (e.g. (Case, et al., 2000; Bełej & Cellmer, 2014)). Alternatively, the effect of such transmission channels could be indirectly examined through their impact on the equity market and accordingly, the listed real estate sector.

GDP is a cardinal macroeconomic indicator, and it is tightly interconnected to all other indicators. That could be clearly induced from the fact that all the studies on Brexit repercussion translated the implications of other indicators into GDP terms. It is hard to link the GDP directly to the real estate market reaction; however, it could be, unequivocally, connected through a median indicator. For instance, a lower GDP could decrease the average income per capita and in turn pressure rents and prices. Or in a broader level, a pressured GDP would trigger an FDI withdrawal, reducing liquidity and prices.

Case et al. (2000) studied the correlation between GDP and returns of different international real estate markets (direct investment). The data covered the period 1987-1997 for 21 countries. The selected countries are diverse. They included European countries, Australia, the USA, and some Asian countries like Hong Kong, Malaysia, Japan, and Thailand. For the 11-year period under study, the results show significant co-movement between GDP and real estate returns. The study suggested that both national and global GDP explain the correlation between international real estate returns, with superiority to local GDP. On a regional level, (Delfim & Hoesli, 2016) compared the impact of GDP, among other macroeconomic variables, on the returns of European listed, non-listed and direct real estate investments, using yearly data for the period 2001 to 2014 and applying panel regression. The findings suggested a positive link between GDP growth and the performance of the real estate instruments under study. Also, it has been found that the listed real estate is as twice as sensitive in contrast to non-listed. Moreover, Edelstein et al. (2011) found a positive correlation between local GDP and excess real estate return for the period 2004-2006. Bełej & Cellmer (2014) added by putting forward that the reaction of the real estate prices to the GDP variable is simultaneous. Their study examined the correlation coefficient between lagged GDP for the period of 0, 6, 12, 18, 24, 30, and 36 months and the average real estate price. They found that the more the span, the weaker coefficient, where the coefficient for the 0 months was 0.967 while for the 36 months the coefficient was 0.833. Additionally, the GDP coefficient in their multivariate regression analysis was statistically significant at the 0,01% level, implying the importance of GDP as a driving force for real estate returns.

Other studies showed a correlation between foreign investment variable and the real estate performance. The magnitude of foreign investment could impact the real estate market directly through increasing the market liquidity, reducing risk premium, and the

capital rate (Cap. rate.) in accordance. In the European context, (Oikarinen & Falkenbach, 2017) examined the determinants of Cap rate. The study deployed Dynamic Ordinary Least Squares (DOLS) and used semi-annual data for the period between 1990- 2015 for the Finnish market (CBD area). They found a statistically significant impact for the share of the foreign investment in the local transaction volumes. That impact takes a negative direction where a 10% increase in the foreign Investment share corresponds to a 30% decrease in the cap rate and accordingly, value appreciation. Worth mentioning that the cap rate is equivalent to the earings-price ratio for a stock (Oikarinen & Falkenbach, 2017). For the US market, (McAllister & Nanda, 2015) studied the US Office markets across 38 metro areas for the period 2001-2013. The study modeled the Cap.-rate determinates and found the foreign investment a significant variable. The study concluded that a 100 basis points increase in the foreign investment leads to 8 basis point decrease in the Cap. Rate. In the same regard, Jiang et al. (1998) explained the role of foreign direct investment in the performance real estate market during a tight Monterey policy in China. The study suggests that cities which attract higher levels of foreign direct investments are able to sustain their real estate markets.

Interest rates and unemployment are also proven to play a significant role in driving real estate prices and returns. On the one hand, the significance of the interest rate is stimulated from the nature of the real estate as a bulky investment; thus, it is a heavily geared asset (Falkenbach & Hoesli, 2017). An increase in the interest rate would raise the cost of debt and consequently pressure the prices and returns of the real estate. Listed, non-listed, and direct, real estate investment vehicles are driven by the performance of the underlying asset, at least on the long term (Hoesli & Oikarinen, 2016). Hence, those vehicles sensitively react to a change in the interest rate. In the European context, Delfim & Hoesli (2016) proxied the interest rate by 10-year real interest rate growth and highlighted a negative reaction from all vehicles from an increase in the interest rate. Ling & Naranjo (1997) found a negative correlation between interest rate and real estate returns in the US, as well. On the other hand, the importance of the unemployment rate is sourced from its negative direct effect on the income level and the purchasing power. Those two factors will subsequently decrease the demand, pressuring the real estate prices down. Lorenz & Trück (2008) studied the effect of the unemployment rate, among others, on different commercial real estate types, including office, retail, residential, industrial. They found that the unemployment rate is a significant variable, in the multivariate regression model used over 1985-2004 span. Bełej & Cellmer (2014) found the same results for interest rate and unemployment rate. Furthermore, their study proposed that prices more sensitively react to the unemployment rate than to the interest rate. Based on their analysis, it took prices seven months to react to a change in the unemployment rate in contrast to 36 months for the interest rate.

Moving to inflaton, in the UK, inflation has almost tripled since the referendum. It spiked from 0,8% in June 2016 to 2,2 in November 2018 (ONS, 2019). Inflation could directly affect the real estate market through an increase in prices or slip through the cap rate. The cap rate is the ratio of the net operating income to market value. It is determined by the risk-free rate, where *Cap rate = risk-free + risk premium – expected growth* (Oikarinen & Falkenbach, 2017). A rise in inflation would, in turn, increase local interest and the risk-free rate. That increase would reflect on a higher cap rate and accordingly, lower prices. Such a loop has been tested in Delfim & Hoesli (2016) study,

mentioned earlier. They examined both expected and unexpected inflation for the period between 2001 and 2014. Listed real estate showed an adverse reaction to the expected inflation yet positive one to the unexpected inflation contrasting the direct and non-listed real estate, which presented the opposite response. Similar, implications could be exhibited from currency fluctuations or even long-term depreciation. Since the Referendum, the pound sterling has depreciated against the Euro by 12% (ONS, 2019). Currency deprecation could initially drag the values down. It would also increase inflation with its consequences. On an international level, Pavlov et al. (2015) found a significant positive correlation between securitized real estate returns and currency fluctuations. Similar to the findings by Vassalou (2000). For a literature review on the effect of currency risk on direct international real estate investment, see Sirmans & Worzala (2003).

In parallel literature, the studies that used the equity market performance as a proxy for macroeconomic performance found significant results that put forward the ability of those variables in explaining the variation in real estate returns. Investigating the excess returns of the international listed real estate, retrieved from GPR for the period between 1984 and 1999, for over 600 companies and 28 countries, Ling & Naranjo (2002) found that both orthogonalized country-specific and global equity performance show strong ability in explaining the excess return on international real estate. Their study employed a multi-factor model, not only on an aggregated index level but also on dis-aggregated firm-level. Bond et al. (2003) found the same results for the explanatory power of both global and country-specific factor explanatory power. There is also evidence that countries of the same region are influenced by the performance of each other. Eichholtz et al. (1988) found that in particular European countries' real estate returns are positively and significantly correlated. The study investigated 12 European countries for the period between 1985-1995. Hamelink & Hoesli (2004) extended the multi-factor of the common and country-specific variable to include the size, value, and growth factors for the period 1990- 2003. The study found that size and value/growth are important factors in explaining the stock returns with a negative correlation.

Following those findings, it could be concluded that macroeconomic indicators as transmission channel play a significant role in real estate performance. And there is a positive correlation between real estate return levels and some macroeconomic factors such as GDP and foreign direct investment. Subsequently, if Brexit is expected to depress such transmission channels, as previously explained, it should be forecasted that real estate companies would experience an adverse reaction to the foreseen repercussions. Alternatively, if Brexit could have positive side-effects on other markets, the opposite response would be expected. Positive side-effects could evolve from possible re-allocations, as discussed by Schelkle (2018) and recorded by Knight-Frank (2018). The move-out of major institutions to other Member states could create a demand shock, especially for the office market, followed by a price increase and consequently positive reaction from real estate companies to capitalize on such opportunity.

The magnitude of the reaction should follow the degree of exposure to those repercussions, positive or negative, exhibiting asymmetric reaction. But as the full Brexit implications are still unknown, "hard" or "soft" it is believed that the response of the real estate companies would, merely, follow the expected consequences revealed

by the chronological news and information that shed light on the magnitude of such consequences.

4 Event Study

One of the employable methods to empirically test the real estate companies' reaction to Brexit event is the application of the event study on securitized real estate. Following the efficient market hypothesis (Fama, et al., 1969; Fama, 1970), the real estate equity market is expected to react to Brexit-related events that deemed unexpected. Furthermore, the reaction should be per the expected consequences of that event. If an event is expected to positively impact the performance, the response should be positive and vice versa. There is abundant literature that employs the event study methodology aiming to investigate the equity market reaction to a relevant event. It is well documented that the equity markets sensitively react to the information revealed from related news and announcements.

4.1. Theoretical Framework

To tackle the study in a theoretical frame, it should be recognized that the event study descends from the Efficient Market Hypothesis (EMH). The EMH extends the random-walk hypothesis, which, in principle, claim that future performance of returns is independent of past performance. It implies that the stock market has "no memory" of the past to predict the future as delineated by Malkiel (2003).

Fama (1970) proposed that for a capital market to be efficient, it has to comprehensively reflect all the available information. His hypothesis suggested three forms of efficiency, "*trichotomy"* as put by Schwartz (1970). First, the *weak* form, where market returns reflect historical information on prices. Second, *semi-strong* form where market returns reflect both the historical information (prices) and all available public information. Third, the *strong* form where the returns reflect the previous categories of information, in addition to, exclusive information known only by insiders, floor traders or privileged group of investors. Worth highlighting that Sharpe (1970) criticized the definition of the price by Fama (1970). Where the latter implied that returns and prices are the same, the former argued that returns are not prices but also dividends. Hence, historical information on returns or "*adjusted prices*" should alter the historical information on prices.

In the "*weak"* form, the author discussed the distinction of the EMH from the random-walk theory. He argued that even if the successive prices are independent of each other, the evidential change in prices is sufficient to present a reflection of new information. In the "*strong"* form, he relied on Niederhoffer & Osborne (1966) findings. Those findings suggest that stock floor traders and corporation insiders have exclusive access to information that could be exploited to gain excess returns. Fama (1970) suggested using "*strong"* form only as "*benchmark*" for market efficiency, meaning that any deviation from efficiency could be attributed to the existence of insiders.

Although both "*weak"* and "*strong"* form of market efficiencies are cardinal, the event study framework could be more concerned with the *semi-strong* form. It implies that market returns would be adjusted to the available public "new" information. In his paper, Fama (1970) braced the hypothesis on the semi-strong form by a "limited" as he stated, precedent empirical studies. For instance, he referred to his work with Fisher, Jensen, and Roll (Fama, et al., 1969). In those studies, the stock split events were

studied to test for stock's abnormal returns around the event. They utilized the market model and residual analysis, where regression analysis was used to regress market return on a specific stock return, and the residuals were considered as a deviation from normal returns. That deviation is called abnormal return caused by the event. The analysis was applied on the monthly data for 940 stock split events, covering the span of 33 years from 1927 to 1959 extracted from the New York Stock Exchange.

In the paper, it was concluded that stock market experiences an abnormal return during the period between the split announcement and the execution of the split. Moreover, the market doesn't react to the event per se, as the split process doesn't increase claim on equity, but rather because the market perceives the split announcement as a signal of confidence where future higher dividends are expected. Those two conclusions were built on the observations after the split execution. It was observed that, first, if the higher profit is realized after the split, no further abnormal movement in the stock return is found. This observation implies that the market already priced in the news of the splits during the announcement period. Second, if the expected high dividends didn't materialize a sharp decrease after the split takes place and rest at close levels before the split nearly by 5 months, which is the average announcement time, that observation implies that the increase in returns between the split announcement and the split is a reaction to the new information of a split event. It confirms the first conclusion and underpins that the market reacts to the consequences of the event, not to the event per se.

To further brace the above conclusions, the literature on political elections events and their impacts on the financial markets would be referenced. (Nippani & Medlin, 2002; Nippani & Arize, 2005; Knight, 2006; Ferri, 2008; Al-Ississ & Miller, 2013; Hachenberg, et al., 2017). Knight (2006) shows that firms which favored Bush over Gore in the 2000 elections gained 9 to 16 percent higher returns during Bush administration. In related work, Ferri (2008) presents how the Bosh victory in 2004 led to a positive stock market reaction. More recently, Hachenberg et al. (2017) studied the effect of Donald Trump's victory in the 2016 U.S. presidential elections on bank stocks and credit default swaps (CDS). An overall positive reaction was experienced by the banks during the event window, (nearly 4.5 percent of abnormal returns on average). The Global Systemically Important Banks (G-SIBs), for example, Bank of America and Citigroup gained more returns, 7.7% in contrast to non-G-SIBs, which earned only 2.88% for the same event window. Same results were found for the CDS, where CDS spreads for non-G-SIBS increased significantly compared to those for G-SIBs. Although the winning of one candidate over another per se will not directly impact the market performance, market reaction was, however, witnessed. That reaction could be attributed to the expectations of how the winning candidate's agenda could impact market performance.

In relevance to the macroeconomy, Waud (1970) examined the market reaction around the announcement of a change in the interest rate by the Federal Reserve Banks. The study employed the same residual method of Fama et al. (1969). The market was proxied by the daily return on the Standard and Poor's (S&P) 500 covering the period from 1952 to 1967. The sample included sixteen increases in discount rates and no decrease. Interestingly, the study finds, however, statistically significant, little effect of the announcement on the first trading day. The first trading day is the "first effective day of the discount rate," succeeding the announcement. More interestingly, abnormal

observations were found in the days preceding the announcements. Waud (1970) regarded those results as market anticipation for the announcement or leak of information by a "*tip-off*." Fama (1970) employed those findings to support further his "*semi-strong*" form, where the market already reacted to the anticipated (leaked) new information and priced in the expectation. In sum, the hypothesis put forward that the market place is rational and respond to new information.

The hypothesis and findings of those early studies are paramount for studying market reaction to Brexit events. Underpinning the EMH, it should be predicted that the market will react to the news and announcements of Brexit. More specifically, when those announcements are perceived as new information that alters expectations. Careful attention would be given to the fact that markets don't react to the event per se, rather the likely repercussions, that motivates the market to respond. Hence, real estate companies are not expected to react to the mere events yet, for the perceived forecasted implications (macroeconomic conditions) of those events on their performance. Since different companies constitute different characteristics and accordingly different exposure level, theoretically, the asymmetric reaction should be witnessed. Asymmetry in reaction could also be exhibited merely due to the company's own perception and assessment of the implications.

4.2. Literature review on event studies

The history of the event studies dates back to a study published by Dolley (1933) when an examination for the stock market reaction to 95 split events between 1921 and 1931 was carried-out (MacKinlay, 1997). A substantial number of studies succeeded afterward. These studies can be segmented by the nature of the event under study. While some focused on firms' specific events, for instance, Fama, et al. (1969) examined the stock split event, and Conrad et al. (2002) analyzed market response to good and bad earnings shocks. Others were concerned with broader world events.

Niederhoffer (1971) carried out the first "in scientific fashion" study on the relationship between world events and stock prices movements. The study applied information content analysis on news' headlines. First, 432 and 399 observations were collected from the *New York Times* and the *Los Angeles Times* publications, respectively, covering the period between 1950 and 1966. Second, the observations (headlines) are categorized based on their content into a wide range of events, for example, war development, peace meeting, sickness and death, cure, elections, change in foreign leadership...etc, and sorted by their day and month of occurrence. Then classified on good/bad scale and, to isolated and non-isolated events.

Additionally, the events were labeled crises or not based on their frequency of appearance in the headlines. The study then tracked the stock market movements in the five days immediately following the event date to see if the change in the stock market after a world event is more extensive than other random trading days. It is found that the stock market tends to react more pronouncedly after a world event than on other random days where the magnitude of reaction is proportional to the size of the event. Moreover, the study found that the magnitude of a response after a crisis is more significant than that of an isolated event. That early literature aided in signaling the event study methodology as a viable approach, where many studies succeed.

Giving the unique character of Brexit, there is scarce to null literature that could be deemed as similar in the context of an event study. Close studies could be those that study the effect of the macro-prudential regulatory reforms. A study by Schwert (1981) is considered to be the first in that regard. The study analyzed the stock market reaction to the announcements of a change in inflation rates using stock market daily returns. Standard and Poor's index was used as a proxy for the market portfolio. The proposition was if the official announcements carry-on a piece of new information on unexpected inflation or deflation, a market reaction should be witnessed. Otherwise, it is hypothesized that the market already anticipated the news, considering that the Consumer Price Index (C.P.I.) takes a month to collect the prices before formally announce it. The existence of transmission channels was hypothesized due to the distributive impacts of unexpected inflation on taxes, interest rates (Fama, 1975; Fama, 1976), and future expected inflation.

Moreover, it was linked to a possible regulation change that would aim to control prices, all of which would reflect on the firm's value forcing its equity prices to react. The study didn't calculate the abnormal returns, as typical, but rather estimated the unexpected returns and then regressed the stock returns on the unexpected return controlling for other variables and used the coefficient on the unexpected return

variable as a piece of evidence for market reaction. The findings concluded a negative reaction around the event period, but no significant reaction was observed on the announcement date, suggesting a probable leakage during the prices collection process and a lack in the market response to the announcement

The most recent studies were conducted after the Global Financial Crisis (GFC) to scrutinize the impact of related reforms on different sectors and to test the hypothesized transmission channels. Those reforms were targeting various financial institutions and/or segments. They aim to regulate further and strengthen the financial system.

On the national level, Schäfer et al. (2015) examined the effect of national financial regulatory reforms on the banking sector by using banking equity prices and credit default swaps. For the period June 2009 to September 2011. The study focused on the Dodd-Frank Act in the USA, Vickers reports in the UK, the restructuring law and bank levy in Germany and too-big-to-fail regulation in Switzerland. To capture the event dates, he relied on the renowned newspapers, for example, Financial Times for both UK, USA and Germany, and Neue Zurcher Zeitung for Switzerland, besides internet searches. Those prudential reforms aimed to control the banking sector's volatility. As they are restricting particular activities, it is hypothesized that the reforms will hinder the sector from engaging in specific businesses and ultimately reduce its profitability. Accordingly, an adverse reaction would be present. The study not only collected the national regulation announcements under review but also confounding international events, to control for their effect. Although the mainstream of the response was negative, there was a divergence in the magnitude of the reaction between institutions. The divergence was a result of the different characteristics those institutions have. For example, the study finds systematic banks to be more negatively affected than non-systematic banks. Based on that, it could be concluded that those characteristics prone those institutions a different degree of exposure to the event repercussions. The original model was, then, tuned with different estimation windows and market portfolios, local and global to test for robustness. Although the effects were the same, it was outlined that the estimated size of the impact depends on the benchmark index.

In the same regard, for Dodd-Frank Act, Sorokina & Thornton Jr. (2015) investigated the reaction of different industries, for example, Trading, Real Estate, Precious metal…etc. The study was carried-out after exploring the change in systematic risk during the initial development of Dodd-Frank. It is found that, although the Act targets the financial institutions, non- financial institutions reacted as well. For elaboration, the financial firms' systematic risk decreased, while the non-financial firms' systematic risk increased. Also, the study suggested that more profitable firms with higher gearing levels and book-to-value ratio reacted more significantly to the Act. Thus, it has been revealed that an event could indeed have a spillover effect, and an institution-specific characteristic could play a role in the reaction level and direction. For further studies on Dodd-Frank, see Gao et al. (2013) and Fier & Liebenberg (2013).

The closest study, to our research, is the one carried-out by Hoesli et al. (2017). That study extends the application of the event study to an international level. It scrutinized the real estate market reaction during the development and enactment of Basel III, the Alternative Investment Fund Management Directive (AIFMD), and the European Market Infrastructure Regulation (EMIR) reforms. It focused on European domiciled companies, the UK, Germany, and France markets, using listed real estate data. Three

hypotheses were proposed, "*profit-based*" hypothesis, which conjectures a positive market reaction resulting from a more resilient financial system, reduction in costs of systematic risks and cheaper costs of debt. A "*regulatory burden*" hypothesis that assumes more restrictive regulation would lead to less credit availability, consequently increased costs of borrowing, which eventually turn to an adverse reaction from the real estate market. Lastly, "*irrelevance*" hypothesis, meaning that no noticeable response would be observed, implying that the real estate sector is irrelevant to those regulatory changes. It could be inferred that the study was testing costs of debt as a transmission channel between the reform and the market reaction.

The results exhibited asymmetric responses toward the three regulatory reforms, across regulation, countries, and company-specific attributes. Besides, it recorded a change in the sampled companies' market beta. Accordingly, the central theme was a different reaction due to different characteristics and the subsequent degree of exposure. For example, the response toward AIFMD maintained the highest significance, giving that AIFMD targets funds structures which could directly affect the real estate markets. In the same regard, companies with higher loan-to-value (LTV) ratio seemed to react more extensively, but insignificantly, to Basel III. Sampled companies' market beta didn't change in the case of Basel III but increased significantly for AIFMD. It was also noticed that France and Germany experienced a more pronounced reaction to AIFMD, due to their companies' size and the basis of legal structure. It was also interesting to find that for 50% of the events related to AFMID, companies reacted positively, which has been attributed to their ability to diversify their source of funding and taking advantage of arbitrage opportunities. EMIR present the least impact on the companies that were sampled in the study.

More on real estate sector-related event studies, Fuller et al. (2019) examined the effect of reclassifying Real Estate Investment Trusts (REITs) in Standard and Poor's 500 (S&P 500) from the Financials sector, to a new sector under the name Real Estate. The sample included the 27 REITs that were registered at the S&P 500 index in Q3, 2016. The effect was tested by calculating the abnormal returns (the difference between the actual return and the expected return) in an event window of 11 days (-5, +5). The findings displayed a mixed response in the abnormal return on the event day. Before and after the event date, the reaction was negative and positive, respectively. Correspondingly, the results for the average abnormal returns were significant before and after the event but insignificant on the event day. In the same study, using the same data, different event windows were tested with four models, market model, market-adjusted model, Fama-French-Three-Factor model, and the same latter model augment with the Momentum Factor. The results confirmed a significant negative average abnormal return before the event and a significant positive one after it.

Interestingly, unlike the frequent use of the stock market prices in an event study, Jung & Lee (2017) used direct house transaction prices to examine the impact of regulations that limits the Debt-To-Income (DTI) and Loan-To-Value (LTV) ratios on the housing prices. Given the expected delay in market response due to the illiquidity characteristic of the direct investments, the event window was (-5, +5 months). Two models were used in the examination, the Constant Mean Return model (CMR) and the Market Return model (MR). Over the period 2006-2015, the number of regulation events was 515, 164 LTV-related, and 351 DTI-related, those events were further sorted to loosening and tightening regulation events. It has been found that the tightening

regulations have a post-event significant negative impacts on house prices growth, on the contrary, the loosening regulation has a significant positive effect on prices growth, both results were observed after 6 months and 2 to 4 months respectively.

The literature that employs event methodology on a broad level, for several events and yield significant results (Schäfer, et al., 2015; Sorokina & Thornton Jr., 2015; Hoesli, et al., 2017; Jung & Lee, 2017) braces the validity of the methodology application in investigating the real estate market reaction to Brexit. Also, they refer to the existence of the transmission channels that links the expected consequences to market reaction. On top of that, they highlight the role of the entity characteristics in determining the degree of exposure to the effects. It is crucial, however, to understand the limitations of such a methodology.

Binder (1985b) aimed to examine the power of the event study in capturing the effect of a regulatory change through testing the statistical significance of several null-hypothesizes. The study covered 20 regulations during the period 1887-1978, using stock market data in an event study framework. Examples of the regulations understudy are Interstate Commerce Act 1887 and Airline Deregulation Act 1987. The announcements were collected from various resources but mainly, *Wall Street Journal* and *New York Times*. Noting that only announcements that were believed to contain new or unanticipated information are included. By using both daily and monthly stock returns and applying a disaggregated multivariate regression analysis, the abnormal returns for each stock/firm were estimated. It was concluded that using daily stock data has advantages over monthly data. However, both daily and monthly data show a regulatory change effect that is statistically insignificant. Binder attributed the weak significance to a misspecification of the announcement date as the regulatory change takes a long period to be negotiated before enactment. Accordingly, the announcements hardy withhold new/unanticipated information. But the study suggested that the methodology is still valid if the announcements containing new information could be precisely specified.

Schäfer et al. (2015) argued the predictability assumption proposed by Binder (1985b). They used the same model as Binder (1985b) and found significant results. Schäfer et al. (2015) argued by saying, “The process produces compromises and surprises, tougher or weaker regulation than initially expected and therefore new information for markets.” But, anecdotally, agreed with MacKinlay (1997) that event study is not suitable for studying international regulations due to the involvement of several parties and the difficulty in controlling information leakage. Thus, the expectations are constantly priced-in instead of suddenly shocking the market. On the other side, Hoesli et al. (2017) extended the application to an international level, without stating an argument in that regard. It worth mentioning that Hoesli et al. (2017) found in his study that some events present more frequent significant responses than others, the highest percentages of significant responses were 67, 45 and 34 percent for AIFMD, Basel III, and EMIR respectively. Accordingly, less frequent significant responses could be attributed to the involvement of several parties in such international events and the available degree of precision in specifying the event dates and/or identify announcements that actually carry new information (Brown & Warner, 1980; Binder, 1985b; Lamdin, 2001).

Based on that, the credibility of employing the event study methodology in investigating the real estate market reaction to Brexit, remarkably, hinges on the accuracy of identifying the right event. The right event should be considered unexpected and holds information that would force the market to shockingly react.

5 Data and Methodology

5.1. Methodology

The assumption of the real estate market rationality and the EMH's semi-strong form considerations motivate this study to employ the event study methodology (for alternatives see Brown & Warner (1980) and Joskow & Rose (1989)). For a definition, "an event study measures the impact of a specific event on the value of a firm" (MacKinlay, 1997). For more elaboration, an event study is concerned with estimating abnormal return which could be defined as the actual return of stock during the event less the normal return that would be expected, had no such event take place. In essence, event studies test the market efficiency, to the extent that the event is unanticipated and carry news that alters expectations. The persistent existence of abnormal return, long after the event, implies that the market lacks efficiency to swiftly reflect the newly disclosed information by that event (Brown & Warner, 1980). In this study, the estimation steps suggested by MacKinlay (1997) will be followed, amended by the considerations proposed by Lamdin (2001).

5.2. Estimation Procedure

5.2.1. Event Selection

Brexit concludes numerous chronological events and announcements. It could be claimed that it started in 2013 when the Prime Minister of UK, David Cameron pledged an in/out referendum in case the Conservative Party win the general elections. Up till the time at which this study is being conducted, and further events are expected to come. The milestones on Brexit's timeline so far could be the Referendum, Invoking Article 50, reaching a withdrawal agreement and the Meaningful Vote"s" (for detailed Brexit time-line see Walker (2019)). Precisely specifying the events that could be regarded as unexpected is challenging, giving the international level of those events. Furthermore, the involvement of several domains, national and international, in the decision-making process prone the information to a leakage. A possible leakage would lead to a gradual pricing-in for that information by the market rather than witnessing a significant abnormal return at any specific period (MacKinlay, 1997; Binder, 1985a).

As the validity of an event study is considerably contingent on specifying the unpredictable announcements, this study will select the Referendum results announcements date as the event date (24th of June 2016). The choice is justified by the voting mechanism of Referendums. It is hard to expect the vote of each and every voter. Thus it was hard rather impossible to predict the results of the referendum. More importantly, the fact that the results were nearly fifty-fifty (48,1% remain and 51,9% leave) further support the choice to claim that the Referendum withheld unanticipated news to the real estate market.

5.2.2. Event Window

The event window is the period over which the market reaction is going to be observed for the event under study. A short event window will be selected to avoid a contaminated reaction considering the event level and the probability of confounding events. Hence, the event window will be 4 trading days (-1,0,+1 +2).

- A pre-event period (t = -1) to count for the voting day and subsequent anticipations;
- The day of the event (t = 0) and;
- A post-event period (t = +1) and (t = +2) taking into consideration the differences in time zones between countries in which the companies under study operate, and a possible delay in market reaction.

5.2.3. Estimation Window

By definition, the Abnormal Returns (ARs) is a deviation from the normal performance. The estimation window is the span of time selected to estimate normal performance (returns). Following the suggested estimation window by MacKinlay (1997) and applied by Fuller et al. (2019), 120 trading days will be appointed as the estimation window. The estimation window will start one trading day prior to the event window (t = -2) and ends at (t = -121). For robustness, estimation widow of 80 days will be examined as well.

5.2.4. Modeling

The aim of a model specified for an event study is to estimate the normal returns and the ARs. The market Equation, initially proposed by Markowitz (1959), will be employed to estimate the normal returns. That Equation advocate that a stock return is a function of a constant (a mean) and market's portfolio performance (beta).

Traditionally, to estimate the ARs, a two-stage OLS regression equation is model. That model aims to analyze the residuals as it represents the abnormal returns, for example, see Fama et al. (1969) and recently, Fuller et al. (2019). This study will, instead, use the "Parametized" model as named by Lamdin (2001). The Parametized model is, in principle, the market model supplemented by a dummy variable to capture the abnormal returns. That approach was originated by Izan (1978). It allows the constant to vary around the event that is represented by a dummy variable. The method has been used in several studies, e.g. Binder (1985a), Schäfer et al. (2015) and Hoesli et al. (2017). It has been argued that the Parametized model is more efficient for estimations as it accounts for high cross-sectional correlations in the residual of the multivariate regression. The high cross-sectional correlations are induced from the fact that the announcements affect all the companies at the same event date (Hoesli, et al., 2017).

Additionally, using the multivariate regression model gives an advantage of testing joint hypotheses. In the same context, as the event would affect all the companies of the same industry, the model will be further amended by an industry return variable. Adding an industry index is an attempt to decrease the variance in the abnormal returns (MacKinlay, 1997), and improve the power of estimations. Salinger (1992) found that

the inclusion of industry index reduces the standard errors of the estimates by roughly 30%. The R-square will be referenced to test the model's power of estimation for variables inclusion. The model will be estimated in a Seemingly Unrelated Regression (SUR) framework. That framework was suggested by (Zellner, 1962). It allows for gaining more efficiency in calculating the standard error as it takes into consideration the cross-section correlation (Binder, 1985a; Schäfer, et al., 2015).

To answer the research question, the Abnormal Returns (ARs) will be estimated and analyzed based on Equation (1):

Equation (1)

$$R_{1t} = \alpha_1 + \beta_1 R_{Mt} + \gamma_1 R_{Nt} + \sum_{n=T-1}^{T+2} \delta_{1n} E_{1nt} + \varepsilon_{1t}$$

....

$$R_{it} = \alpha_i + \beta_i R_{Mt} + \gamma_i R_{Nt} + \sum_{n=T-1}^{T+2} \delta_{in} E_{int} + \varepsilon_{it}$$

....

$$R_{It} = \alpha_I + \beta_I R_{Mt} + \gamma_I R_{Nt} + \sum_{n=T-1}^{T+2} \delta_{In} E_{Int} + \varepsilon_{It}$$

Where

R_{it}	denote the return of company *i* at time *t*.
α_i	denote the constant of company *i*
β_i	denote the market beta of company *i*
γ_i	denote the industry beta of company *i*
R_{Mt}	denote the market return at time t (same for all companies)
R_{Nt}	denote the industry return at time t (same for all companies)
E_{int}	denote a dummy variable that represents the event: equals 1 if event n occur on time *t* and 0 otherwise
δ_{in}	denote the influence of event *n* on the return of company *i*, (Abnormal Return)
ε_{it}	denote the error term/random disturbance

The dummy coefficient δ_{in} measure the abnormal returns (ARs) for company *i*, while R_{Nt} *and* R_{Mt} are the industry's portfolio and market's portfolio return respectively proxied by a benchmark. The choice of a benchmark for those two portfolio's performances is a question of robustness. Schäfer et al. (2015) and Hoesli et al. (2017) mentioned that the use of global index reduces the contamination effect results from the interdependence between different industries within the same country and the spillover effect across countries, respectively. However, considering that those variables aim to estimate the normal returns of the companies under study by providing a market portfolio proxy, the global index might not accurately reflect the market portfolio because it might fail to reflect country-specific performance. Accordingly, in this study, both local and global index will be tested. *T* is the day of the Referendum's result announcement.

E_{int} represents the events' dummy variable. Lamdin (2001) suggested three alternatives for the event dummy variable representation in the multivariate regression model. (1) A separate dummy for each sub-event within the event, (2) a single dummy to represent the entire event window (i.e., all periods in the window), or (3) a single dummy to represent only the individual sub-event within the event window. Alternative (1) is advantageous to track the impact of each sub-event, to observe the reaction direction, positive or negative, and to test the null hypothesis for each sub-event separately (Binder, 1985b). However, misspecification of the event's date is probable. On the other hand, alternative (2) is more able to capture the effect of the event nevertheless the positive and negative effect of each sub-events will not be traceable, resulting in a misleading total effect. Also, the inclusion of non-relevant dates is possible. Alternative (3) is a compromisation between the first two. As the research scope is limited to only one sub-event (Referendum), Alternative (1) will be followed using a dummy variable for each day in the event window, instead of one dummy for the whole window. Accordingly, the results will be able to track the reaction direction (negative/positive) during the event window and avoid the discharge effect.

In order to test the study hypothesis, first, the Cumulative Abnormal Returns for each sampled company will be calculated according to Equation (2). Second, the CAR for each company *i* will be regressed on the company's exposure to the UK market as it is assumed to reflect the negative repercussions of Brexit. Additionally, the company's exposure to possible re-allocation benefits will be tested. For the latter test, German and French markets will be sampled (company's exposure to German/French market). The choice of Germany and France comes from the fact that they are the second biggest listed real estate market after the UK (EPRA, 2017; EPRA, 2019) and more importantly because they are prominent candidates for hosting the re-allocations (Knight-Frank, 2018). Accordingly, they are hypothesized to reflect the possible positive side-effects of Brexit. The exposure will be tested on both the company-level and country level for the UK market, But only on company-level for German and French market

Equation (2)

$$CAR_i(t_0, t_N) = \sum_{t=0}^{t=N} AR_{it}$$

Where

CAR_i	denote the cumulative abnormal return of company *i*.
AR_{it}	denote the abnormal returns of company *i* at time *t*
t	denote the time interval at the cumulative abnormal return for company *i* will be summed

On the company level, Equation (3), the company will be considered exposed to the tested market (UK, Germany, or France), if it directly invests in that market through property ownership. The level of exposure will be calculated as the ratio of the number of properties owned in the market that is assumed to reflect Brexit repercussion to the total number of properties owned by the company. A negative coefficient is hypothesized for exposure to the UK market, while a positive one is assumed for both the French and German markets. A significant coefficient on the company's exposure variable would confirm those hypotheses (the research hypotheses). The equation will

be augmented by the company's size, debt to capital ratio, and tax status as control variables. The reason for choosing those variables is their significance in explaining the variance in a real estate company return. The tax status is whether the company is a Real Estate Investment Trust (REIT) or a Real Estate Operating Company (REOC) for literature on the difference in characterizes see Niskanen & Falkenbach (2012). The company size will be proxied by its market capital at the date of the event. Furthermore, the company's sector and investment focus will be examined. As the re-allocations are expected to pressure the demand on offices and the rental market, Equation (3) will be augmented by a dummy variable that is equal to 1 if the company's sector is office and 0 otherwise, as well as, a dummy variable that is equal to 1 if the company's investment focus is rental and 0 otherwise.

Equation (3)

$$CAR_i = \alpha_i + \partial_i Exp\_UK_i + +\pi_i Exp\_Germany_i + +\infty_i Exp\_France_i + \lambda_i\, Size_i + \propto_i\, DtoCap_i + \emptyset_i REIT_i + \Omega_i Rental_i + \mu_i Office_i + \varepsilon_i$$

Where

Exp_UK_i	denotes the level of exposure of company *i* to the UK market.
$Exp\_Germany_i$	denotes the level of exposure of company *i* to the German market.
Exp_France_i	denotes the level of exposure of company *i* to the French market.
$Size_i$	denotes the logged market capital (free float) of company *i*
$DtoCap_i$	denotes the debt to capital ratio of the company *i*
$REIT_i$	denotes a dummy that represents the tax status of company *i* (equals 1 if the company is REIT and 0 otherwise)
$Rental_i$	denotes a dummy that represents the investment focus of company *i* (equals 1 if the company is Rent focused and 0 otherwise)
$Office_i$	denotes a dummy that represents the sector to which company *i* belongs (equals 1 if the company's sector is office and 0 otherwise)
ε_i	denote the error term/random disturbance.

On a country level, Equation (4), the CAR will be regressed on the trading intensity between the country-of-incorporation and the UK. The trading intensity will be measured as the ratio between the country's export of goods to the UK and its total exports to the EU in the year of the event, 2016. The values will range from 0 (least exposure) to 1 (highest exposure). Companies that are incorporated in the United Kingdom are assumed to have the highest exposure and according will take the value of 1. The GDP of company's country-of-incorporation will augment the Equation as a control variable referencing the literature suggestions, that GDP has power in explaining the real estate market returns (Case, et al., 2000; Bełej & Cellmer, 2014; Delfim & Hoesli, 2016)

Equation (4)

$$CAR_i = \alpha_i + \partial_i Trade\_Int + \lambda_i \log\_GDP_i + \varepsilon_i$$

Where

$Trade\_Int$	denotes *the ratio between the* company *i's country of incorporation export of goods to the UK and its total exports intra -EU.*
GDP_i	denotes logged country-of-incorporation's GDP of the company i
ε_i	denote the error term/random disturbance.

5.3. Data

5.3.1. Observation Intervals

Some event studies used monthly data (Brown & Warner, 1980; Schipper & Thompson, 1983; Jung & Lee, 2017), while many others used daily data (Schäfer, et al., 2015; Hoesli, et al., 2017; Fuller, et al., 2019). Morse (1984) investigated the choice between daily and monthly data. The study focused on the level of efficiency and bias of the estimates of the mean of abnormal returns using daily and monthly data. It found no superiority for either; however, daily returns are preferable in many cases. That is consistent with Brown & Warner (1980) that suggested monthly data might spill noise on the true event effect. Brown & Warner (1985) analyzed the impact of the daily data characteristics on the event study and suggested that the inherited downsides of the daily data, for example, autocorrelation and non-normality, do not impact the power of the event study. Also, because Brexit is an international event and the study will utilize company's specific data, using monthly intervals will hinder the ability to control, if needed, for company's particular events that might confound in the same month or week with Brexit events, for example, earning announcements. Thus, following Schäfer et al. (2015), Hoesli et al. (2017) and Fuller et al. (2019), this research will use daily data intervals.

Based on that, the total daily returns are selected to represent the companies' return. For the market portfolio STOXX Europe, 600 will be chosen, while for the industry portfolio FTSE EPRA Nareit developed Europe will be selected. Worth mentioning that the total return index for both portfolios will be selected rather than the mere change in price, following the argument of Sharpe (1970). The data is retrieved from Eikon-DataStream. For the robustness test, FTSE developed Europe as a market portfolio will be examined as well. Besides, local indices will be used by sampling Germany, because the German market is considered as a candidate for future re-allocation and the German companies represent the second biggest share in the study sample and the overall listed real estate market, following British companies.

5.3.2. Data Sample

The sample consists of 52 companies. The reason for choosing those companies is data availability and limitations. Other companies have unreported returns for the period of examination (Jan 2015 to July 2016), or they have not been publicly listed one year before the event. All the sampled companies have been listed at least one year before the event, to allow for a more accurate normal returns estimations. 46 companies are incorporated in an EU Member State while 6 are incorporated in non-EU Member State. 33 of the companies are REITs while the other 19 are REOCs. The countries in our sample are United Kingdom, Germany, France, Netherlands, Belgium, Italy, Austria, Norway, and Switzerland. The number of observations for each company is the sum of the trading days of the event window plus those of the estimation window, (t = -121 to t = +2). All the sampled companies are constituents of the FTSE EPRA Nareit Developed Europe at the time of the event. They represent 57 % of the total number of European companies (92) constituted the index at the event date. It weighs over 70% of the total index's free-float market capital, see table 5. The company's market-capital, its REIT status, sector, and investment focus are collected from EPRA. The debt to total capital ratio is retrieved from *Eikon*, datastream, and property ownership and geographical location are sourced from S&P Global Market Intelligence. The trading volumes and the GDP data are extracted from both Eurostat and OECD. For the sample descriptive statistics, see table 6.

Table 5 *Sample Weights*

Country	No. Of companies	%Wght in Index	%Wght in the sample
Austria	1	0,54	0,76
Belgium	7	3,03	4,26
France	3	4,33	6,07
Germany	10	18,95	26,59
Italy	1	0,14	0,19
Netherland	5	13,88	19,47
Norway	2	0,39	0,54
Switzerland	4	5,57	7,82
United Kingdom	19	24,45	34,30
Total	**52**	**71,28**	**100**

Source: EPRA, 2016

Table 6 *Sample descriptive statistics*

Variable	Obs	Mean	Std. Dev.	Min	Max
Market Captial (Euro –million)	52	2728.423	4041.671	210	23008
Debt to Capital	51	.3494466	.1127327	.1138055	.6606454
Exp_UK	52	.3194119	.4355428	0%	100%
Exp_Germany	52	.2087462	.377475	0%	100%
Exp_France	52	.0659194	.1679186	0%	99%
Office	52	.1730769	.3783431	0	1
REIT	52	.4615385	.4985572	0	1
rental	52	.7307692	.4435945	0	1
Trade_Int	52	.4333329	.4319384	.0001387	1
log (GDP)	52	41094.23	10606.16	27900	72300

6 Results

The results were concluded in the following order: first, the Abnormal Returns (ARs) are estimated using Equation (1) to record companies' reaction, then the Cumulative Abnormal Returns (CARs) are calculated according to Equation (2). Second, to test the research hypothesis, the CARs are regressed on the company's level of exposure to three markets that are assumed to reflect Brexit repercussions, UK, Germany, and France, the regression follows Equation (3). The company is determined to be exposed to a specific market if it directly invests in it through property ownership. The level of exposure is the percentage of the number of properties owned in the affected market to the total number of properties. Lastly, to test whether the companies' country-of-incorporation and its trading relationship with the UK have power in explaining the reaction was investigated through regressing the CARs on the trading intensity between country-of incorporation and the UK. The trading intensity is measured as the ratio between the country's export of goods to the UK and its total exports to the EU.

After running Equation (1) in the SUR framework for the observations understudy, the results show a statistically significant Abnormal Normal Returns (ARs) from the sampled companies, see table 7. The largest statistically significant positive reaction recorded is 12,54% (% change in total daily returns) while the smallest is 1,3% for a British, and a French company respectively, with a mean of 4,0%. On the contrary, the highest statistically significant negative reaction witnessed is -15,2% whereas the lowest is -1,7% for a British, and a Dutch company respectively, with a mean of -5,8%. It is noticed that British companies considerably dominates the negative reactions; they represent 85% of the significantly negative observations. The rest of the 15% is equally distributed between Austria, Germany, Italy, Netherland, and Belgium with only one observation for each, except for Netherland, it has two observations. On the other hand, German companies dominate the significant positive reaction, with nearly 28% of the observations, followed by 12% for British companies. In the same regard, companies that are incorporated in Norway show no significant results during the 4 trading days of the event window.

The number of significant results varies within the event window. On the event day ($t = 0$), 85 % (44 companies) of the sample presents a statistically significant ARs. 81% (36 companies) of those ARs were significant at the 0,01 level. On the post-event day ($t = +1$), the percentage was lower, where only 65% (34 companies) of the sample show a statistically significant ARs with 74% (25 companies) significant at the 0,01% level. On the day ($t = +2$) the significant ARs represents 32% (17 companies) with nearly half significant at the 0,01% level. For the day ($t = -1$) there is almost no statistically significant ARs from the sampled companies, only 3 companies with merely 0,1% level statistical significance. For the complete results, standard errors and the R-square of the system of equations, see appendix I, pp. 1-2.

***Table** 7 The Estimated Abnormal Returns and their statistical significance.*

Country of Incorporation	Company Name	Abnormal Returns			
		Pre-event (t =-1)	Event (t = 0)	Post-event (t =1)	Post-event (t =2)
Austria	CA Immobilien Anlagen AG	0.708	5.393***	0.429	-1.727*
Belgium	Aedifica SA	-0.187	5.746***	0.541	0.875
Belgium	Befimmo SA	0.0434	3.872***	0.885	-0.385
Belgium	Cofinimmo SA	0.216	2.920***	1.777***	-0.202
Belgium	Intervest Offices & Warehouses NV	1.794*	1.292	-1.105	0.802
Belgium	Leasinvest Real Estate SCA	0.0698	4.314**	2.674*	-5.810***
Belgium	Warehouses de Pauw Comm VA	-0.0920	4.703***	3.912***	-0.942
Belgium	Wereldhave Belgium Comm VA	-0.737	2.094	2.333	0.463
France	Covivio SA	-0.229	5.069***	2.173***	-0.463
France	Gecina SA	0.152	1.782**	-0.604	1.323*
France	Mercialys SA	-0.278	1.772*	1.770*	0.819
Germany	Adler Real Estate AG	-0.142	5.542**	2.930	-2.105
Germany	alstria office REIT AG	0.103	6.451***	1.173	-0.398
Germany	Deutsche Euroshop AG	-0.0576	3.971***	1.088	0.0370
Germany	Deutsche Wohnen SE	-0.388	8.177***	5.671***	-0.801
Germany	DIC Asset AG	-0.262	8.098***	2.604**	-1.027
Germany	Hamborner Reit AG	0.293	4.919***	1.737*	-0.153
Germany	LEG Immobilien AG	-1.188	6.684***	3.027***	-0.486
Germany	TAG Immobilien AG	0.242	5.392***	2.780**	-0.0602
Germany	TLG Immobilien AG	-1.127	5.511***	0.0833	-0.274
Germany	Vonovia SE	-1.490	9.433***	7.484***	-3.841***
Italy	Immobiliare Grande Distribuzione SIIQ SpA	-1.219	5.954***	1.120	-3.460*
Netherlands	Eurocommercial Properties NV	-0.895	1.824*	1.260	0.683
Netherlands	NSI NV	-1.012	5.376***	-2.215**	0.713
Netherlands	Vastned Retail NV	-0.941	3.157***	1.796*	-0.928
Netherlands	Wereldhave NV	0.539	1.694*	0.569	-1.027
Netherlands	WFD Unibail Rodamco NV	0.418	2.878***	2.427***	-1.723**
Norway	Entra ASA	-1.023	0.881	0.140	1.338
Norway	Norwegian Property ASA	-0.125	0.497	1.268	2.040
Switzerland	Allreal Holding AG	-0.496	2.115***	0.170	0.121
Switzerland	Mobimo Holding AG	0.324	2.918***	1.594**	-0.724

Switzerland	PSP Swiss Property AG	0.824	6.121***	-0.0747	-0.200
Switzerland	Swiss Prime Site AG	-0.307	5.183***	2.005***	-0.457
United Kingdom	Big Yellow Group PLC	-0.282	-3.677**	-2.595*	0.662
United Kingdom	British Land Company PLC	-0.107	-9.817***	-5.188***	1.804**
United Kingdom	Capital & Counties Properties PLC	0.553	-6.856***	-6.350***	2.682**
United Kingdom	Daejan Holdings PLC	1.319	-3.296**	-13.78***	12.54***
United Kingdom	Derwent London PLC	-0.289	-15.18***	-7.964***	3.308***
United Kingdom	Grainger PLC	1.543	-8.157***	-4.632***	1.804*
United Kingdom	Hammerson PLC	0.305	-4.557***	-4.398***	3.092***
United Kingdom	Hansteen Holdings PLC	0.647	-1.213	-4.374***	0.990
United Kingdom	Helical PLC	2.005	-12.31***	-9.568***	-3.096**
United Kingdom	Intu Properties PLC	0.426	-3.365***	-3.014***	1.007
United Kingdom	Land Securities Group PLC	-0.301	-5.931***	-4.632***	5.515***
United Kingdom	Londonmetric Property PLC	0.730	-3.415***	-7.700***	4.514***
United Kingdom	Primary Health Properties PLC	1.760*	0.485	-1.158	0.00259
United Kingdom	Safestore Holdings PLC	0.173	-9.601***	-6.173***	0.738
United Kingdom	SEGRO PLC	0.0549	-4.103***	-2.960***	4.765***
United Kingdom	Shaftesbury PLC	0.161	-1.158	-4.624***	0.991
United Kingdom	Tritax Big Box Reit PLC	0.782	-2.820***	-7.472***	6.788***
United Kingdom	Unite Group PLC	0.141	0.669	-4.009***	0.533
United Kingdom	Workspace Group PLC	2.680*	-6.845***	-10.55***	1.369

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Within the event window, 42% of the statistically significant reactions are negative reactions in contrast to a majority of 58% positive reaction. The Coefficient of Variation (CV) for both negative and positive reactions is almost the same, which equals to 0,56. As both the event date ($t = 0$) and the trading day after ($t = 1$) sustain the most significant ARs with the highest levels of significance, they were further referenced for reaction-asymmetry investigation. The observed Abnormal Returns for ($t = 0$) and ($t = 1$) maintain a variation in both direction and magnitude, see table 8. It is found that on (t

= 0), 34 % of the statistically significant ARs were negative. While on (t = +1) the number increased to reach nearly 53%. Accordingly, on average, 44% of the sampled companies experienced a negative reaction while the rest harvest a positive one.

Furthermore, the coefficient of variation (the ratio of the standard deviation to the mean) for both dates ARs is substantially greater than 1, which refers to a significant variance in those ARs. All the companies that encountered significant negative ARs on those two dates are incorporated in the United Kingdom except for only one, incorporated in Netherland. However, that Dutch company encountered the least negative reaction -2,2 % within these two days. The most negative reaction for those two days is the same as for the whole event widow, -15,18% suffered by a British company. In the same context, the coefficient of variation (the ratio of the standard deviation to the mean) for the ARs at both dates (t = 0) and (t = +1) is substantially greater than 1, which refers to a significant variance in those ARs.

Table 8 *Abnormal Returns Descriptive Statistics*

Variables	Obs	Mean	Std. Dev.	Min	Max	*CV
AR at (t = 0)	52	.7805	5.601511	-15.18	9.433	7.1768238
(-) ARs	17	-6.017706	3.922778	-15.18	-1.158	.6518727
(+) ARs	35	4.082486	2.343565	.485	9.433	.57405344
AR at (t =1)	52	-1.109988	4.31708	-13.78	7.484	3.8893013
(-) ARs	23	-5.006074	3.381007	-13.78	-.0747	.67538091
(+) ARs	29	1.98001	1.614517	.0833	7.484	.81540845

**Coefficient of Variation (absolute values)*

Equation (1) results were robust to the different tests. Using 80 days of estimation window yields nearly the same results of the positive and negative significant Abnormal returns, see Appendix I, pp. 3-4. Substituting Stoxx 600 with FTSE Developed Europe as a market portfolio displays on average the same magnitude of reaction, see Appendix I, pp. 5-6. Moreover, sampling the companies incorporated in Germany, using a local index (DAX) demonstrates the same positive reaction witnessed from using STOXX 600 and the FTSE Developed Europe, see table 9. Germany was selected as it is the second-biggest real estate market after the United Kingdom. Also, most of the sampled companies are incorporated in Germany after the United Kingdom. Besides, the results show that German companies harvest most of the significant positive reaction observed. For the complete results, standard errors and the R-square of the system of equations, see Appendix I, p.7.

Table 9 *The Estimated Abnormal Returns (using local index, German Case)*

		Abnormal Returns			
Country of Incorporation	Company name	Pre-event (t =-1)	Event (t = 0)	Post-event (t =1)	Post-event (t =2)
Germany	Adler Real Estate AG	-0.329	5.452**	2.827	-2.048
	alstria office REIT AG	0.0925	6.124***	1.037	-0.309
	Deutsche Euroshop AG	-0.0398	3.684***	0.915	0.147
	DIC Asset AG	-0.263	8.150***	2.567**	-1.008
	Deutsche Wohnen SE	-0.406	7.400***	5.217***	-0.514
	Hamborner Reit AG	0.422	4.899***	1.853*	-0.215
	LEG Immobilien AG	-1.179	6.239***	2.868***	-0.379
	TAG Immobilien AG	0.181	5.862***	2.997**	-0.203
	TLG Immobilien AG	-1.116	5.370***	0.164	-0.313
	Vonovia SE	-1.557*	9.231***	7.396***	-3.785***

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Building on the results that depict high percentage of statistically significant ARs observed for (t = 0) and (t = +1), and the relative insignificance of the other dates of the event window, the Cumulative Abnormal Returns (CARs) are only calculated for (t = 0) and (t = +1) employing Equation (2), see table 10. By estimating the CARs' magnitude and direction, it is observed that nearly 63% of the companies (33 companies) maintained the positive direction, while the other 37 % (19 companies) show a negative one. Only and all companies incorporated in the UK suffered negative CARs with the highest value of -23,1% and lowest of -0,7%. Companies incorporated in other countries experienced positive CARs. The largest positive CAR is 16,9% for a German Company while the smallest is 0,2% for a Belgium company. On average Germany show the largest positive CARs. Furthermore, the coefficient of variation for all CARs calculated preserved a value considerably greater than 1, see table 11.

Table 10 *The Cumulative Abnormal Returns*

Country	Name	CAR
Austria	CA Immobilien Anlagen AG	5,822
Belgium	Aedifica SA	6,287
	Befimmo SA	4,757
	Cofinimmo SA	4,697
	Intervest Offices & Warehouses NV	0,187
	Leasinvest Real Estate SCA	6,988
	Warehouses de Pauw Comm VA	8,615
	Wereldhave Belgium Comm VA	4,427
France	Covivio SA	7,242
	Gecina SA	1,178

	Mercialys SA	3,542
Germany	Adler Real Estate AG	8,472
	alstria office REIT AG	7,624
	Deutsche Euroshop AG	5,059
	Deutsche Wohnen SE	13,848
	DIC Asset AG	10,702
	Hamborner Reit AG	6,656
	LEG Immobilien AG	9,711
	TAG Immobilien AG	8,172
	TLG Immobilien AG	5,5943
	Vonovia SE	16,917
Italy	Immobiliare Grande Distribuzione SIIQ SpA	7,074
Netherlands	Eurocommercial Properties NV	3,084
	NSI NV	3,161
	Vastned Retail NV	4,953
	Wereldhave NV	2,263
	WFD Unibail Rodamco NV	5,305
Norway	Entra ASA	1,021
	Norwegian Property ASA	1,765
Switzerland	Allreal Holding AG	2,285
	Mobimo Holding AG	4,512
	PSP Swiss Property AG	6,0463
	Swiss Prime Site AG	7,188
United Kingdom	Big Yellow Group PLC	-6,272
	British Land Company PLC	-15,005
	Capital & Counties Properties PLC	-13,206
	Daejan Holdings PLC	-17,076
	Derwent London PLC	-23,144
	Grainger PLC	-12,789
	Hammerson PLC	-8,955
	Hansteen Holdings PLC	-5,587
	Helical PLC	-21,878
	Intu Properties PLC	-6,379
	Land Securities Group PLC	-10,563
	Londonmetric Property PLC	-11,115
	Primary Health Properties PLC	-0,673
	Safestore Holdings PLC	-15,774
	SEGRO PLC	-7,063
	Shaftesbury PLC	-5,782
	Tritax Big Box Reit PLC	-10,292
	Unite Group PLC	-3,34
	Workspace Group PLC	-17,395

Table 11 *Cumulative Abnormal Returns Descriptive Statistics*

Variable	Obs	Mean	Std. Dev.	Min	Max	*CV
CARs	52	-.3294885	9.496436	-23.144	16.917	28.821758
(-) CARs	19	-11.17305	6.127788	-23.144	-.673	.54844351
(+) CARs	33	5.913776	3.548948	.187	16.917	.60011546

**Coefficient of Variation (absolute values)*

After obtaining the CARs, the hypothesis test is carried out. The test aims to examine the level of exposure's ability to explain the variance in the CARs' magnitude and direction. The level-of-exposure will be tested on both the company level and country-of-incorporation level.

On a company level, the examination looks for interpreting the negative reaction by the exposure level to the UK market and explaining the positive one through the exposure to the German and French markets (Markets of possible re-allocations). The analysis is carried out in two steps. First, the correlation coefficient matrix was estimated to test for possible multi-collinearity between the independent variables. Second, CARs are regressed on the independent variables following Equation (3). On a country level, the same steps are taken, but only the exposure to the UK market is investigated. The exposure is proxied by the trading intensity between the company's country-of-incorporation and the UK.

On the one hand, the correlation matrix demonstrates a significant correlation (at 0,05% level) between CARs and the variable of interest, see table 12, exposure to the UK (Exp_UK), exposure to Germany (Exp_Germany) and trading intensity (trd_int), except for exposure to France (Exp_France). The results suggest a weak correlation between the independent variables as well. Such low correlation coefficients encourage the inclusion of those variables in the regression equation, Equation (3) and Equation (4). Also, the substantial correlation coefficient between trd_int and Exp_UK motivates testing the country level exposure in a separate equation, Equation (4).

Table 12 *Correlation Significance Matrix*

Variables	CAR	Exp_UK	Exp_Germany	Exp_France	size	DtoCap
CAR	1.0000					
Exp_UK	-0.8751*	1.0000				
p-value	0.0000					
Exp_Germany	0.5226*	-0.3907*	1.0000			
p-value	0.0001	0.0042				
Exp_France	0.0682	-0.1894	-0.1801	1.0000		
p-value	0.6309	0.1786	0.2013			
size	0.0197	0.1280	0.0762	0.2811*	1.0000	
p-value	0.8900	0.3660	0.5914	0.0435		
DtoCap	0.5128*	-0.4082*	0.5018*	-0.0799	-0.0450	1.0000

p-value	0.0001	0.0029	0.0002	0.5774	0.7539	
REIT	-0.1168	0.2030	-0.2412	0.0792	-0.1768	-0.0753
p-value	0.4097	0.1489	0.0850	0.5766	0.2100	0.5996
office	0.0672	-0.1605	-0.0362	-0.1493	-0.0880	-0.0427
p-value	0.6359	0.2558	0.7989	0.2907	0.5348	0.7661
rental	-0.1449	0.2499	-0.1344	-0.1228	0.0505	-0.1477
p-value	0.3056	0.0740	0.3423	0.3857	0.7223	0.3011
trd_int	-0.8688*	0.9594*	-0.4058*	-0.1538	0.1438	-0.3921*
p-value	0.0000	0.0000	0.0028	0.2763	0.3092	0.0044
log_GDP	0.2170	-0.3173*	-0.1129	-0.1634	0.0180	0.0759
p-value	0.1223	0.0219	0.4257	0.2472	0.8992	0.5966

Varaibles	REIT	office	rental	trd_int	log_GDP
REIT	1.0000				
office	-0.0157	1.0000			
p-value	0.9121				
rental	0.1271	0.0485	1.0000		
p-value	0.3692	0.7329			
trd_int	0.1814	-0.1407	0.1580	1.0000	
p-value	0.1981	0.3199	0.2634		
log_GDP	-0.4496*	0.4495*	-0.1732	-0.2909*	1.0000
p-value	0.0008	0.0008	0.2194	0.0364	

** p<0.05*

On the other hand, after estimating Equation (3), the findings, see table 13, Specification 1, delineate a statistically significant negative coefficient for Exp_UK and Exp_France variables, where the null hypothesis can be rejected at the 0,05 % and 0,1% levels respectively. Additionally, the result shows a positive significant coefficient for Exp_Germany variable at the 0,1% significance level. The inclusion of the control variables leads to having an explanatory power, R-square, of 0,86. The control variables, size and REIT/tax status (REIT) maintain a significant coefficient at levels 0,01% and 0,05% respectively. While the other control variables show no statistical significance. As the exposure was proxied by the direct investment in the UK market, the geographical allocation of the direct investments by each of the sampled companies is presented on maps combined by country-of-incorporation, see maps combined by country in appendix II, pp.1-9.

Moreover, the company's exposure to the specific cities of Frankfurt and Paris is examined using Equation (3) and substituting Exp_Germany by the exposure to Frankfurt (Exp_Frankfurt) and Exp_France by the exposure to Paris (Exp_France). The company is considered exposed to Frankfurt and/or Paris if it owns at least one property in the city, where the Exp_Frankfurt (Exp_Paris) variable is dummy variable that equals 1 if the company owns property in Frankfurt (Paris) and 0 otherwise. The output, see table 13, Specification 2, present a significant negative coefficient for Exp_Paris at the 0,05% level and an insignificant positive coefficient for the Exp_Frankfurt variable. In

specification (2) the exposure to the UK (Exp_UK) variable almost maintained identical significance, magnitude, and direction as in specification (1). Also, the size variable shows nearly the same effect as in specification (1). However, the debt to capital (DtoCap) control variable appears to be significant with a positive impact, and the REIT/Tax status (REIT) shows no statistically significant effect.

Table 13 *Equation (3) Regression Output*

Specification (1)		Specification (2)	
Variables	CAR	Variables	CAR
Exp_UK	-19.17***	Exp_UK	-19.93***
	(1.635)		(1.670)
Exp_Germany	3.129*	Exp_Frankfurt	1.624
	(1.848)		(2.065)
Exp_France	-7.552*	Exp_Paris	-4.215**
	(4.016)		(2.051)
size	1.516***	size	1.730***
	(0.552)		(0.567)
DtoCap	8.744	DtoCap	11.91**
	(5.909)		(5.772)
REIT	2.548**	REIT	1.972
	(1.201)		(1.208)
office	-1.773	office	-2.393
	(1.516)		(1.595)
rental	1.467	rental	1.744
	(1.303)		(1.347)
Constant	-10.34**	Constant	-12.02**
	(4.500)		(4.614)
Observations	51	Observations	51
R-squared	0.859	R-squared	0.849

Standard errors in parentheses
**** p<0.01, ** p<0.05, * p<0.1*

After scrutinizing Equation (3) to test the exposure hypothesis on the company level, Equation (4) is estimated to test the same hypothesis but on a country level, the level of exposure is proxied by the trading intensity between the company's country-of-incorporation and the UK. The results suggest a statically significant coefficient for the trade intensity (trd-int) variable, with a null hypothesis rejection at the 0,05% level. The GDP (the country's Gross Domestic product in 2016-logged) as a control variable was insignificant in the Equation (4) 's specification, but the overall explanatory power of the Equation is as high as 0,78, see table14. It is worth mentioning that if companies incorporated in the UK are excluded, the significance of trading intensity coefficient and the overall Equation explanatory power diminishes, see Appendix II, p.10.

Table 14 *Equation (4) Regression Output*

VARIABLES	CAR
trd_int	-19.17***
	(1.605)
log_GDP	-1.758
	(3.315)
Constant	26.61
	(35.35)
Observations	52
R-squared	0.756

Standard errors in parentheses
**** p<0.01, ** p<0.05, * p<0.1*

7 Discussion

The empirical results of the research adjacently follow the literature. As the findings demonstrate, statistically significant Abnormal Returns (ARs) during the specified event window refers to European real estate companies' reaction to Brexit when it is proxied by the referendum event. That reaction is most vivid on the results' announcement day, 24th of June 2016, and the next trading day, however, it was interesting to observe almost no significant reaction on the referendum day itself, 23rd of June 2016. That could be attributed to the assumption that the market was not intrinsically shocked by the referendum event but rather by the results after it was announced. That attribution is braced by the fact that the referendum was long planned for, preceding its occurrence. It could be said that it sparked when Prime Minister David Cameron first pledged the referendum in January 2013 and ignited by the Royal Assent on December 2015 and the formal announcement of the "D" day on February 2016. Such period allowed the market to take precaution reactions along that timeline. Accordingly, no significant response has been observed. Alternatively, that insignificant reaction could further enhance the hypothesis that the referendum results were totally unanticipated, and the market bit on the Remain campaign to win (Van Reenen, 2016).

In the same regard, the statistical significance of the Abnormal Returns (ARs) on the results announcement date and the next trading day sheds light on the answer of the first research question. Besides ratifying the existence of companies' reaction to Brexit, significant ARs validates companies' expectations for possible repercussions on the real estate sector and the existence of transmission channels, that would transmit a mere voting event to a macroeconomic disruption and an ultimate implication on the real estate return drives. In the light of the literature, a disturbance in the macroeconomic variables could directly affect the real estate companies' performance as they are intrinsically return drivers (Case, et al., 2000; Bełej & Cellmer, 2014; Delfim & Hoesli, 2016; Oikarinen & Falkenbach, 2017) or indirectly through their impact on the equity market and accordingly, the listed real estate sector (Ling & Naranjo, 2002; Bond, et al., 2003). Hoesli & Oikarinen (2012) found that the listed real estate is more prone to equity market movements than to the direct real estate, on the short terms. Hence, Either directly or indirectly, implications were expected. Such consequences could be a change in market liquidity through the foreign direct investment channel, or a disturbance in the cost of debt through the interest rate channel. Also, it would transcend to an overall increase in market volatility and the subsequent risk due to uncertainty about the demand volumes. Such uncertainty could evolve, as well, from the effect of fluctuations in GDP, trading volumes or currency value on income levels, unemployment and/or purchase power.

Moving to the exhibited variation in the magnitude and direction Abnormal Returns (ARs), both positive and negative statistically significant ARs, with variant magnitude, were observed. Such observations answer the second research question. It proves the existences of asymmetric reaction from the sampled real estate companies. That variation was also robust to the Cumulative Abnormal Returns calculations. The CARs show that 33 (19) companies, with different country-of-incorporation, experienced a positive (negative) reaction, respectively. Such observation further confirms the asymmetry characteristic of the reaction. The variation in the magnitude of the response was highly anticipated, giving the various attributes of the sampled companies, for

instance, the size, country of incorporation, investment focus, debt ratio...etc, let alone the heterogeneous characteristics of the underlying properties. Such characteristics prone the company to a different level of exposure to the source of the effect, having it to react in an idiosyncratic manner. Companies that are incorporated in the UK dominate the significant reaction observed generally and the negative reactions specifically while those incorporated in Germany dominates the positive reaction. The negative reaction was predicted due to the expected adverse effect of Brexit and its transmission channels on the UK market as suggested by the contemporaneous studies (HM-Treasury, 2016; OECD, 2016; Bruno, et al., 2016; Van Reenen, 2016; Dhingra, et al., 2017; Sampson, 2017; IMF, 2018)

On the contrary, positive reactions witnessed are attributed to expected beneficial repercussion. The father of value investing, Benjamin Graham said: “The stock market is a voting mechanism in the short-term and weighing mechanism on the long-term" from that quote it could conceptualize that those companies that reacted positively implicitly bless Brexit. In principle, the positive reaction could an attempt to capitalize on the expected re-allocations. If Brexit materializes, investment institutions will likely re-allocate from the UK to a different EU center, such as Frankfurt or Paris, to preserve access to the Single (Schelkle, 2018). It is suggested that Germany and France are prominent alternatives. The findings conform to the German choice as the highest positive reaction was observed for the companies incorporated in Germany. In contrast to France as an alternative, our results suggested the several countries preceded France in the magnitude of the positive reaction.

Building on the above discussion, the exhibited statistically significant coefficient of level-of exposure variables, on both company and country levels (Exposure to the UK, Germany, and France markets) confirms the research hypothesis. They highly express the ability of those variables in explaining the variance in the magnitude and direction of the company's reaction. In other words, those variables affect the characteristics of the companies’ reaction.

The negative effect of the exposure to the UK market (Exp_UK) and the trading intensity (trd_int) suggests that companies with higher exposure to the UK-market experienced a more downward aggressive reaction. negative effects are developed, initially, from the fact that Brexit is estimated to have a truculent implication on the UK market accordingly, the market started to price-in those implications, pressuring the company’s value, and subsequently, the abnormal returns. For more elaboration, on the company level, owning property in the market that maintains the highest exposure to the negative consequences would unequivocally reflect on inferior property values. The source of the inferior value could evolve mainly from the adverse impact on the rent growth and demand levels or a higher cost of debt, all of which, significantly motivate adverse reaction. On the Country level, the macroeconomics are expected to play a significant role. Giving that Brexit will foremost negatively affect the trading costs and volumes, the markets that rely on exporting to the UK are accordingly expected to reflect the most considerable reaction. As trading is correlated to other prominent macroeconomic factors (e.g., GDP), those market will undoubtedly carry more risks that would reflect on the asset values and correspondingly real estate. Such transmission channels would explain and justify the adverse reaction and its correlation with the exposure level.

In the same context, the negative coefficient on the variables of exposure to the French market, both to France in general (Exp_France), and Paris in specific (Exp_Paris) was an interesting observation. It was hypothesized that the French market could be a future winner from the re-allocations a resulted from Brexit. Based on that, exposure to such a market should have a positive effect on the exposed companies' returns. However, the adverse reaction could be attributed either objectively to a sampling error. Or subjectively by quoting the father of value investing, Benjamin Graham when he said "The stock market is a voting mechanism in the short-term and weighing mechanism on the long-term" inducing that those companies envisage Brexit as a sign of further withdrawals from European Union thus reacted negatively, voting no to Brexit.

On the other side, the positive coefficient on the exposure to the German market (Exp_Germany) braces the future winner hypothesis. It highlights that companies are trying to capitalize on the re-allocations that in turn would increase the demand and consequently, the prices. It was interesting to find no statistical significance on the exposure to Frankfurt specifically. However, that could be interpreted as the companies do not perceive Frankfurt as the main host to possible allocations, but several other cities are also competing. (Knight-Frank, 2018) in their recent study, show that Berlin and Munich share some the implemented re-allocation projects although their share is relatively small.

7.1. Conclusion

After the leave campaign win in a historic referendum, United Kingdom (UK) was voted to divorce the European Union (EU) in an event titled Brexit. Since then, Brexit has been a prominent topic in most, if not all, the economic agendas. The event gravity does not only evolve from its unique character but also from the significant role that the UK exhibits in the world market economy in general and particularly in the EU's. The event gains the attention of several studies trying to understand and anticipate the repercussions. The main concern is for the UK to be deprived of the Single Market privileges either partially of completely. Those repercussions could be perceived as a chain reaction starting with a mere vote and ending with a possible substantial drag in the GDP and several other microeconomic factors.

It is without a doubt that Brexit implications will transcend to impact the performance of various economic sectors, including the real estate market. The effect on the real state sector would be stemmed from its exposure and sensitivity to the possible transmission channels. From an economic perspective, those transmission channels are expected to be the very same channels that transmit a mere event to a potential downfall in the GDP, macroeconomic channels. Several studies have been conducted to investigate the sensitivity of the real estate market to the various macrocosmic indicators and especially the GDP (Ling & Naranjo, 1997; Case, et al., 2000; Lorenz & Trück, 2008; Bełej & Cellmer, 2014; Delfim & Hoesli, 2016; Oikarinen & Falkenbach, 2017). Those studies suggest that the possible transmission channels would negatively affect the real estate market, giving the negative impact of Brexit on those transmission channels initially. It is difficult to estimate the precise extent of each of those channels as Brexit didn't metalize yet, let alone the current debates and no consensus on the future of UK-EU ties. However, it is possible to record the market reaction, leaning on the Efficient Market Hypothesis (EMH) proposed by Fama (1970). The EMH concludes that the market reacts to news that alters expectations, where the direction of the reaction follows the direction of the forecasted news' impacts. Thus, the real estate market reaction was hypothesized to react to Brexit events that withhold unanticipated information with magnitude and direction equivalent to the level of exposure to the implication of this information.

The empirical findings of the research disclose an asymmetric statistically significant reaction from the real estate companies toward Brexit. In empirical testing, the real estate market was proxied by its listed European sector and three markets that are assumed to reflect Brexit repercussions were tested; UK, Germany, and France. The reaction was investigated by detecting Abnormal Returns during the referendum event window in an event study framework. The results support the correlation between the degree of exposure to the transmission channels of Brexit and the magnitude of the reaction. It is, to a great extent, confirming the EMH and the sensitivity of the real estate market to possible changes in the macroeconomic indicators. As Brexit is expected to affect the macroeconomic performance of the UK market adversely, the degree of exposure to the UK was found to negatively affect the reaction, forcing it to the negative direction.

On the contrary, as the German market is expected to capitalize on investment institution re-allocations a positive response was detected from companies that are

exposed to the German market. In the French market case, the results were unexpected. Although France is considered to be a significant candidate for the re-allocations accordingly similar results to the German market have been anticipated, the exposure for the French market during the referendum yielded a negative effect on the real estate companies. The findings lend credence to the possible implications of Brexit on the real estate idiosyncratic factors. For adverse repercussion, It could mainly increase costs of debt, decrease market liquidity and demotivate rental/value growth because of short-term uncertainty, increased risk and tightened credit channels or a long term fall in GDP, FDI, employment rate and income levels. For positive impacts, substantial re-allocation could initiate a shock in demand, and as the real estate cycle is relatively long giving the time of constructions, the supply would be stressed leading to a possible increase in real estate market values, prices and accordingly its stock returns.

7.2. Evaluation of research

It could be fairly adjudged that there is no research without limitations, and this research is no exception. Limitation of the study could arise initially from the selected empirical framework, event study. The application of an event study methodology for such an enormous event has been widely criticized (Binder, 1985b; MacKinlay, 1997). It is induced that the cardinal point in assessing the validity of the application of that framework heavily leans on the precise selection of the event date, the date at which the market actually perceived the information released as unanticipated and accordingly reacts. Given the vastness of the event and the involvement of many entities, it is difficult to define an exact date at which the market is shocked and accordingly reacted. It could be allegedly said that the event so far spans 5 years starting in 2015 when British Prime Minister David Cameron pledged the referendum. Since then, many chronological events followed at which the market could have reacted and already priced in Brexit repercussions.

Consequently, the witnessed reaction around any of Brexit events could be only a fraction of the real response. Or else the reaction could be contaminated by the effect of other confounding events, considering the broadness of Brexit and the mount of traded information every day. Hence, it is difficult to separate the impact and decide if the reaction was exclusively due to a Brexit related event. The research sought to alleviate these limitations by carefully selecting the referendum relying on the nearly fifty-fifty results as evidence of a market shock. However, those limitations hinder the research ability to validate the estimated magnitude of the reaction and merely employ it to witness the reaction and its direction.

Besides, it was difficult to assess the overall magnitude due to the immensity of Brexit, its unique characteristic, and the vastness of possible consequences. Accordingly, any total extent to be estimated is highly expected to be volatile at least until the UK officially exits the EU and puts forward the nature of the withdrawal agreement. Moreover, the magnitude of the reaction should be equivalent to the size of the implications (Fama, 1970), assuming no over or under-reaction. And as the total extent is hard to foresee, it was challenging to assess their magnitude. Even with the current estimations about the overall fall in GDP still, those estimations are not reliable enough as most of them depend on reversal effect and a lot of the consequences could take different turns, considering time change.

Another source of limitation is the sample weight, which could shadow the research ability to generalize its results. The study was carried on only 52 companies out of 92 companies constituted the FTSE EPRA Nareit Index in 2016 and out of 392 possible European listed real estate company (sourced from Eikon DataStream). The limitation in including more companies has two main reasons. Limited accurate time-series data available on the stock of those companies and the condition instituted by the research that a company to be included has to be listed at least one year before the event date. In the same regard, it could be claimed that the sample is dominated by UK-incorporated companies 19 companies (36.5%) out of the 52. Such domination could bias the results toward the idiosyncratic reaction of those companies. That claim was vivid during the examination, as by excluding the UK-incorporated-companies, the exposure to the UK (trade intensity) variable in Equation (4) become statistically insignificant which mean the exposure fails to explain the variance in the reaction. In contrast, it could be argued

that the sample maintained the same weight (36%) of UK companies in the FTSE EPRA Nareit index in 2016.

In the same context, the selection of the securitized real estate companies to proxy the real estate companies reaction hinders the examination of the non-listed real estate companies' reaction. non-listed real estate companies' reaction could differ in the short term, see Hoesli & Oikarinen (2012) and Hoesli & Oikarinen (2016). Moreover, the selection of direct investment (property ownership) as a proxy for exposure to a specific market, weakened the study ability to examine the correlation between the reaction and the indirect investment. Especially that several numbers of our sampled companies have no direct investments in the UK market.

7.3. Future research

It could be claimed that the study widely opens the doors for future research. It would be of primary interest to follow the Brexit events as they evolve, detecting further real estate market reaction — for instance, the election of the new prime in July 2019. Predominantly, after October 2019 a further investigation should look for a possible reversal reaction if a withdrawal agreement is to be reached between UK-EU to alleviate the worst-case scenario. Detecting such a reversal reaction could fundamentally brace the Efficient Market Hypothesis (Fama, 1970). Comparing the magnitude of the reversal reaction to the initial one should give an idea about how the market perceived the new agreement. It will show if the market sees the deal as a complete hedge against negative consequence, through an equal reversed magnitude. Or just a workaround to alleviate the implications (partially reversed magnitude). More interestingly, if an agreement was not concluded and no market reaction is detected. It could be an opportunity for an initial assessment of an overall magnitude of Brexit on real estate sector on the short-term. In that context, the sample size should be expanded to reflect the average true extent.

Another interesting elaboration would be testing the immigration as a transmission channel that conveys Brexit repercussions to the real estate market performance. It could examine the countries that maintain high labor exportation to the UK has been negatively affected by Brexit, considering the possible reallocation that would lead to employment-restructuring and possible job losses. The findings of those aforementioned potential studies could further assets in understanding the impact of Brexit on the real estate market. Also, it would further strengthen the academic knowledge about the correlation between macroeconomic changes and the real estate market performance.

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APPENDIX I

Equation (1) Regression Output – 120 Trading-days

Country of Incorporation	Company name	Pre-event (t =-1)	SE	Event (t = 0)	SE	Post-event (t =1)	SE	Post-event (t =2)	SE	Constant	SE	Obs.	R-squared
Germany	Adler Real Estate AG	-0.142	(1.945)	5.542**	(2.247)	2.930	(2.014)	-2.105	(1.970)	-0.172	(0.176)	124	0.182
Switzerland	Allreal Holding AG	-0.496	(0.567)	2.115***	(0.632)	0.170	(0.582)	0.121	(0.572)	0.0430	(0.0514)	124	0.439
Belgium	Aedifica SA	-0.187	(1.033)	5.746***	(1.181)	0.541	(1.067)	0.875	(1.045)	0.0830	(0.0937)	124	0.416
Germany	alstria office REIT AG	0.103	(0.767)	6.451***	(0.893)	1.173	(0.796)	-0.398	(0.778)	-0.00710	(0.0696)	124	0.663
United Kingdom	Tritax Big Box Reit PLC	0.782	(0.672)	-2.820***	(0.770)	-7.472***	(0.694)	6.788***	(0.680)	0.0227	(0.0609)	124	0.773
Belgium	Befimmo SA	0.0434	(0.809)	3.872***	(0.919)	0.885	(0.834)	-0.385	(0.819)	0.0473	(0.0734)	124	0.632
United Kingdom	British Land Company PLC	-0.107	(0.807)	-9.817***	(0.940)	-5.188***	(0.838)	1.804**	(0.819)	-0.0198	(0.0732)	124	0.902
United Kingdom	Big Yellow Group PLC	-0.282	(1.385)	-3.677**	(1.600)	-2.595*	(1.434)	0.662	(1.403)	0.0410	(0.126)	124	0.538
Austria	CA Immobilien Anlagen AG	0.708	(1.036)	5.393***	(1.172)	0.429	(1.067)	-1.727*	(1.047)	-0.0857	(0.0940)	124	0.564
United Kingdom	Capital & Counties Properties PLC	0.553	(1.304)	-6.856***	(1.511)	-6.350***	(1.351)	2.682**	(1.321)	-0.180	(0.118)	124	0.779
Belgium	Cofinimmo SA	0.216	(0.639)	2.920***	(0.726)	1.777***	(0.659)	-0.202	(0.647)	0.0666	(0.0580)	124	0.716
France	Covivio SA	-0.229	(0.677)	5.069***	(0.770)	2.173***	(0.698)	-0.463	(0.685)	0.0138	(0.0614)	124	0.818
Germany	Deutsche Euroshop AG	-0.0576	(0.720)	3.971***	(0.832)	1.088	(0.745)	0.0370	(0.729)	0.0295	(0.0653)	124	0.712
Germany	DIC Asset AG	-0.262	(1.068)	8.098***	(1.245)	2.604**	(1.109)	-1.027	(1.083)	-0.103	(0.0968)	124	0.586
United Kingdom	Daejan Holdings PLC	1.319	(1.162)	-3.296**	(1.354)	-13.78***	(1.206)	12.54***	(1.178)	-0.125	(0.105)	124	0.750
United Kingdom	Derwent London PLC	-0.289	(0.859)	-15.18***	(0.991)	-7.964***	(0.889)	3.308***	(0.870)	-0.0613	(0.0779)	124	0.918
Germany	Deutsche Wohnen SE	-0.388	(0.967)	8.177***	(1.111)	5.671***	(1.000)	-0.801	(0.979)	0.111	(0.0877)	124	0.609
Norway	Entra ASA	-1.023	(1.245)	0.881	(1.397)	0.140	(1.280)	1.338	(1.258)	0.111	(0.113)	124	0.242
France	Gecina SA	0.152	(0.763)	1.782**	(0.872)	-0.604	(0.788)	1.323*	(0.772)	0.115*	(0.0692)	124	0.743
United Kingdom	Grainger PLC	1.543	(1.071)	-8.157***	(1.244)	-4.632***	(1.111)	1.804*	(1.086)	0.00185	(0.0972)	124	0.759
Germany	Hamborner Reit AG	0.293	(1.016)	4.919***	(1.180)	1.737*	(1.053)	-0.153	(1.029)	0.0277	(0.0921)	124	0.450
United Kingdom	Helical PLC	2.005	(1.354)	-12.31***	(1.568)	-9.568***	(1.403)	-3.096**	(1.372)	-0.141	(0.123)	124	0.745
United Kingdom	Hammerson PLC	0.305	(0.703)	-4.557***	(0.823)	-4.398***	(0.731)	3.092***	(0.713)	-0.0210	(0.0638)	124	0.881
United Kingdom	Hansteen Holdings PLC	0.647	(1.001)	-1.213	(1.160)	-4.374***	(1.038)	0.990	(1.015)	-0.0513	(0.0908)	124	0.516
Italy	Immobiliare Grande Distribuzione SIIQ SpA	-1.219	(1.915)	5.954***	(2.188)	1.120	(1.977)	-3.460*	(1.938)	-0.0680	(0.174)	124	0.508

United Kingdom	Intu Properties PLC	0.426	(0.925)	-3.365***	(1.077)	-3.014***	(0.960)	1.007	(0.938)	0.00369	(0.0839)	124	0.813
United Kingdom	Land Securities Group PLC	-0.301	(0.864)	-5.931***	(1.001)	-4.632***	(0.895)	5.515***	(0.875)	0.00612	(0.0783)	124	0.874
Germany	LEG Immobilien AG	-1.188	(1.008)	6.684***	(1.158)	3.027***	(1.042)	-0.486	(1.021)	0.0674	(0.0914)	124	0.603
United Kingdom	Londonmetric Property PLC	0.730	(0.770)	-3.415***	(0.891)	-7.700***	(0.798)	4.514***	(0.781)	-0.00537	(0.0699)	124	0.790
Belgium	Leasinvest Real Estate SCA	0.0698	(1.525)	4.314**	(1.738)	2.674*	(1.574)	-5.810***	(1.543)	0.150	(0.138)	124	0.180
France	Mercialys SA	-0.278	(0.912)	1.772*	(1.042)	1.770*	(0.941)	0.819	(0.923)	0.0511	(0.0827)	124	0.578
Switzerland	Mobimo Holding AG	0.324	(0.616)	2.918***	(0.681)	1.594**	(0.631)	-0.724	(0.622)	0.00736	(0.0560)	124	0.516
Norway	Norwegian Property ASA	-0.125	(1.886)	0.497	(2.083)	1.268	(1.931)	2.040	(1.903)	-0.0949	(0.171)	124	0.096
Netherlands	NSI NV	-1.012	(1.080)	5.376***	(1.213)	-2.215**	(1.110)	0.713	(1.091)	-0.0292	(0.0980)	124	0.420
United Kingdom	Primary Health Properties PLC	1.760*	(1.033)	0.485	(1.206)	-1.158	(1.072)	0.00259	(1.047)	0.00252	(0.0936)	124	0.244
Belgium	Intervest Offices & Warehouses NV	1.794*	(0.968)	1.292	(1.104)	-1.105	(0.999)	0.802	(0.980)	0.0658	(0.0879)	124	0.312
Switzerland	PSP Swiss Property AG	0.824	(0.570)	6.121***	(0.643)	-0.0747	(0.587)	-0.200	(0.576)	0.0635	(0.0517)	124	0.705
United Kingdom	Safestore Holdings PLC	0.173	(1.343)	-9.601***	(1.568)	-6.173***	(1.395)	0.738	(1.362)	0.101	(0.122)	124	0.632
United Kingdom	SEGRO PLC	0.0549	(0.711)	-4.103***	(0.821)	-2.960***	(0.736)	4.765***	(0.720)	0.0296	(0.0645)	124	0.854
United Kingdom	Shaftesbury PLC	0.161	(0.716)	-1.158	(0.838)	-4.624***	(0.744)	0.991	(0.726)	0.0288	(0.0649)	124	0.760
Netherlands	Eurocommercial Properties NV	-0.895	(0.868)	1.824*	(0.987)	1.260	(0.895)	0.683	(0.878)	-0.0222	(0.0788)	124	0.693
Switzerland	Swiss Prime Site AG	-0.307	(0.603)	5.183***	(0.684)	2.005***	(0.622)	-0.457	(0.610)	0.105*	(0.0547)	124	0.660
Germany	TAG Immobilien AG	0.242	(1.248)	5.392***	(1.444)	2.780**	(1.293)	-0.0602	(1.264)	0.0451	(0.113)	124	0.513
Germany	TLG Immobilien AG	-1.127	(1.024)	5.511***	(1.191)	0.0833	(1.062)	-0.274	(1.038)	0.112	(0.0929)	124	0.543
Netherlands	WFD Unibail Rodamco NV	0.418	(0.665)	2.878***	(0.770)	2.427***	(0.689)	-1.723**	(0.674)	0.0208	(0.0603)	124	0.817
United Kingdom	Unite Group PLC	0.141	(0.992)	0.669	(1.142)	-4.009***	(1.026)	0.533	(1.004)	-0.0183	(0.0900)	124	0.656
Netherlands	Vastned Retail NV	-0.941	(0.960)	3.157***	(1.091)	1.796*	(0.990)	-0.928	(0.971)	-0.0724	(0.0871)	124	0.614
Germany	Vonovia SE	-1.490	(0.907)	9.433***	(1.055)	7.484***	(0.941)	-3.841***	(0.919)	0.0954	(0.0822)	124	0.727
Belgium	Warehouses de Pauw Comm VA	-0.0920	(1.044)	4.703***	(1.175)	3.912***	(1.073)	-0.942	(1.055)	0.0403	(0.0947)	124	0.603
Netherlands	Wereldhave NV	0.539	(0.785)	1.694*	(0.901)	0.569	(0.811)	-1.027	(0.794)	-0.146**	(0.0712)	124	0.736
Belgium	Wereldhave Belgium Comm VA	-0.737	(1.427)	2.094	(1.634)	2.333	(1.474)	0.463	(1.444)	0.0370	(0.129)	124	0.257
United Kingdom	Workspace Group PLC	2.680*	(1.493)	-6.845***	(1.736)	-10.55***	(1.549)	1.369	(1.514)	-0.128	(0.135)	124	0.709

Standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Equation (1) Regression Output – 80 Trading-days

Country of Incorporation	Company name	Pre-event (t =-1)	SE	Event (t = 0)	SE	Post-event (t =1)	SE	Post-event (t =2)	SE	Constant	SE	Obs.	R-squared
Germany	Adler Real Estate AG	0.129	(1.710)	2.139	(2.142)	1.076	(1.823)	-1.250	(1.746)	0.0405	(0.190)	84	0.083
Switzerland	Allreal Holding AG	-0.391	(0.462)	1.564***	(0.529)	-0.121	(0.479)	0.324	(0.468)	0.0333	(0.0514)	84	0.442
Belgium	Aedifica SA	-0.299	(0.734)	5.763***	(0.909)	0.697	(0.780)	0.816	(0.749)	0.0725	(0.0816)	84	0.558
Germany	alstria office REIT AG	0.167	(0.755)	6.183***	(0.968)	1.030	(0.811)	-0.287	(0.773)	-0.0195	(0.0839)	84	0.561
United Kingdom	Tritax Big Box Reit PLC	0.646	(0.655)	-1.792**	(0.845)	-6.852***	(0.706)	6.499***	(0.672)	-0.0399	(0.0729)	84	0.836
Belgium	Befimmo SA	0.199	(0.719)	2.242**	(0.910)	0.0880	(0.769)	0.0852	(0.735)	0.0825	(0.0799)	84	0.601
United Kingdom	British Land Company PLC	-0.210	(0.698)	-9.045***	(0.894)	-4.888***	(0.750)	1.522**	(0.715)	0.0248	(0.0776)	84	0.940
United Kingdom	Big Yellow Group PLC	-0.345	(1.300)	-3.780**	(1.678)	-2.650*	(1.400)	0.617	(1.332)	0.0920	(0.145)	84	0.603
Austria	CA Immobilien Anlagen AG	0.684	(1.045)	6.149***	(1.232)	0.749	(1.093)	-1.916*	(1.061)	-0.106	(0.116)	84	0.483
United Kingdom	Capital & Counties Properties PLC	-0.00914	(1.240)	-4.044**	(1.635)	-4.989***	(1.346)	1.573	(1.274)	-0.0467	(0.138)	84	0.838
Belgium	Cofinimmo SA	0.445	(0.409)	1.601***	(0.511)	1.184***	(0.436)	0.301	(0.418)	0.00101	(0.0455)	84	0.806
France	Covivio SA	-0.0919	(0.634)	4.381***	(0.787)	1.773***	(0.674)	-0.218	(0.647)	0.0180	(0.0705)	84	0.763
Germany	Deutsche Euroshop AG	0.139	(0.720)	3.308***	(0.905)	0.677	(0.768)	0.327	(0.736)	0.00724	(0.0800)	84	0.625
Germany	DIC Asset AG	-0.184	(0.888)	7.300***	(1.162)	2.123**	(0.961)	-0.829	(0.912)	-0.0383	(0.0987)	84	0.528
United Kingdom	Daejan Holdings PLC	1.343	(1.040)	-4.196***	(1.357)	-14.23***	(1.124)	12.74***	(1.067)	-0.0571	(0.116)	84	0.842
United Kingdom	Derwent London PLC	-0.411	(0.793)	-14.65***	(1.046)	-7.798***	(0.861)	3.050***	(0.815)	0.0225	(0.0881)	84	0.946
Germany	Deutsche Wohnen SE	-0.125	(0.894)	7.507***	(1.137)	5.135***	(0.958)	-0.490	(0.915)	0.114	(0.0994)	84	0.520
Norway	Entra ASA	-0.657	(1.223)	-1.510	(1.405)	-1.060	(1.269)	2.153*	(1.238)	0.0920	(0.136)	84	0.144
France	Gecina SA	0.471	(0.626)	0.300	(0.802)	-1.416**	(0.673)	1.894***	(0.641)	0.0812	(0.0696)	84	0.759
United Kingdom	Grainger PLC	1.481*	(0.800)	-7.796***	(1.060)	-4.430***	(0.870)	1.682**	(0.823)	-0.00255	(0.0890)	84	0.880
Germany	Hamborner Reit AG	0.379	(0.823)	4.519***	(1.068)	1.560*	(0.889)	0.0170	(0.844)	-0.00410	(0.0915)	84	0.455
United Kingdom	Helical PLC	1.808	(1.259)	-11.07***	(1.597)	-9.016***	(1.348)	-3.554***	(1.287)	-0.0875	(0.140)	84	0.822
United Kingdom	Hammerson PLC	0.240	(0.617)	-3.787***	(0.793)	-4.045***	(0.664)	2.869***	(0.632)	-0.0301	(0.0686)	84	0.922
United Kingdom	Hansteen Holdings PLC	0.572	(0.954)	-0.731	(1.220)	-4.139***	(1.025)	0.822	(0.977)	-0.0427	(0.106)	84	0.580
Italy	Immobiliare Grande Distribuzione SIIQ SpA	-0.732	(1.479)	3.754**	(1.894)	-0.249	(1.590)	-2.662*	(1.515)	-0.0358	(0.164)	84	0.473

United Kingdom	Intu Properties PLC	0.258	(0.975)	-1.707	(1.294)	-2.257**	(1.061)	0.499	(1.002)	0.00281	(0.108)	84	0.823
United Kingdom	Land Securities Group PLC	-0.442	(0.816)	-4.702***	(1.028)	-4.160***	(0.872)	5.088***	(0.834)	0.0648	(0.0907)	84	0.907
Germany	LEG Immobilien AG	-0.908	(0.859)	5.810***	(1.091)	2.487***	(0.920)	-0.0821	(0.879)	0.0234	(0.0955)	84	0.551
United Kingdom	Londonmetric Property PLC	0.621	(0.789)	-2.089**	(0.995)	-7.054***	(0.843)	4.147***	(0.807)	-0.0434	(0.0878)	84	0.832
Belgium	Leasinvest Real Estate SCA	-0.210	(1.581)	5.959***	(1.971)	3.545**	(1.684)	-6.381***	(1.614)	0.156	(0.176)	84	0.198
France	Mercialys SA	0.0164	(0.800)	1.800*	(1.014)	1.767**	(0.857)	1.101	(0.818)	-0.130	(0.0889)	84	0.611
Switzerland	Mobimo Holding AG	0.444	(0.582)	2.159***	(0.689)	1.222**	(0.609)	-0.458	(0.590)	-0.00570	(0.0647)	84	0.449
Norway	Norwegian Property ASA	-0.217	(1.602)	-0.551	(1.871)	0.799	(1.671)	2.168	(1.625)	0.0264	(0.178)	84	0.100
Netherlands	NSI NV	-0.964	(1.034)	5.820***	(1.275)	-2.013*	(1.097)	0.669	(1.054)	-0.0873	(0.115)	84	0.421
United Kingdom	Primary Health Properties PLC	1.905**	(0.922)	-0.457	(1.183)	-1.604	(0.991)	0.335	(0.944)	-0.0205	(0.102)	84	0.273
Belgium	Intervest Offices & Warehouses NV	2.030**	(0.934)	-0.408	(1.185)	-2.020**	(1.001)	1.334	(0.956)	0.101	(0.104)	84	0.308
Switzerland	PSP Swiss Property AG	0.886	(0.599)	5.623***	(0.735)	-0.314	(0.634)	-0.0407	(0.610)	0.0628	(0.0666)	84	0.602
United Kingdom	Safestore Holdings PLC	-0.103	(1.373)	-8.500***	(1.815)	-5.578***	(1.491)	0.272	(1.411)	0.155	(0.153)	84	0.692
United Kingdom	SEGRO PLC	0.00519	(0.709)	-3.075***	(0.913)	-2.472***	(0.763)	4.511***	(0.726)	-0.0157	(0.0788)	84	0.879
United Kingdom	Shaftesbury PLC	0.284	(0.594)	-1.945**	(0.778)	-5.109***	(0.643)	1.227**	(0.610)	0.0707	(0.0660)	84	0.834
Netherlands	Eurocommercial Properties NV	-0.622	(0.782)	0.622	(0.949)	0.640	(0.826)	1.175	(0.796)	-0.0793	(0.0870)	84	0.672
Switzerland	Swiss Prime Site AG	-0.112	(0.567)	4.806***	(0.701)	1.787***	(0.602)	-0.202	(0.578)	0.0299	(0.0630)	84	0.540
Germany	TAG Immobilien AG	0.530	(1.106)	3.484**	(1.420)	1.861	(1.189)	0.601	(1.133)	0.0113	(0.123)	84	0.398
Germany	TLG Immobilien AG	-1.054	(0.951)	4.966***	(1.218)	-0.125	(1.021)	-0.0728	(0.974)	0.0783	(0.106)	84	0.495
Netherlands	WFD Unibail Rodamco NV	0.383	(0.539)	3.649***	(0.689)	2.873***	(0.579)	-1.881***	(0.552)	-0.0583	(0.0599)	84	0.853
United Kingdom	Unite Group PLC	0.261	(0.906)	0.546	(1.157)	-4.128***	(0.972)	0.654	(0.927)	-0.0523	(0.101)	84	0.705
Netherlands	Vastned Retail NV	-0.988	(0.810)	2.824***	(1.030)	1.790**	(0.868)	-0.850	(0.829)	-0.101	(0.0900)	84	0.626
Germany	Vonovia SE	-1.133	(0.814)	8.177***	(1.043)	6.766***	(0.874)	-3.283***	(0.834)	0.0288	(0.0905)	84	0.606
Belgium	Warehouses de Pauw Comm VA	0.292	(0.844)	2.612***	(0.996)	2.789***	(0.883)	-0.193	(0.856)	0.0235	(0.0938)	84	0.570
Netherlands	Wereldhave NV	0.471	(0.733)	2.119**	(0.948)	0.881	(0.791)	-1.136	(0.752)	-0.195**	(0.0815)	84	0.752
Belgium	Wereldhave Belgium Comm VA	-0.889	(1.335)	2.043	(1.665)	2.442*	(1.422)	0.373	(1.363)	0.0647	(0.148)	84	0.277
United Kingdom	Workspace Group PLC	2.289*	(1.349)	-5.111***	(1.754)	-9.795***	(1.457)	0.609	(1.384)	0.0271	(0.150)	84	0.806

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Equation (1) Regression Output – FTSE Developed Europe Index

Country of Incorporation	Company name	Pre-event (t =-1)	SE	Event (t = 0)	SE	Post-event (t =1)	SE	Post-event (t =2)	SE	Constant	SE	Obs.	R-squared
Germany	Adler Real Estate AG	-0.107	(1.948)	5.649**	(2.225)	3.012	(2.015)	-2.173	(1.972)	-0.176	(0.177)	124	0.181
Switzerland	Allreal Holding AG	-0.470	(0.567)	2.045***	(0.625)	0.182	(0.581)	0.103	(0.572)	0.0419	(0.0514)	124	0.441
Belgium	Aedifica SA	-0.131	(1.033)	5.557***	(1.167)	0.573	(1.065)	0.831	(1.044)	0.0814	(0.0936)	124	0.417
Germany	alstria office REIT AG	0.106	(0.769)	6.365***	(0.884)	1.169	(0.796)	-0.399	(0.778)	-0.00630	(0.0696)	124	0.664
United Kingdom	Tritax Big Box Reit PLC	0.800	(0.672)	-2.905***	(0.763)	-7.462***	(0.694)	6.774***	(0.680)	0.0225	(0.0609)	124	0.773
Belgium	Befimmo SA	0.0470	(0.813)	3.771***	(0.914)	0.896	(0.838)	-0.398	(0.822)	0.0483	(0.0737)	124	0.629
United Kingdom	British Land Company PLC	-0.104	(0.809)	-9.753***	(0.930)	-5.177***	(0.838)	1.797**	(0.819)	-0.0208	(0.0732)	124	0.903
United Kingdom	Big Yellow Group PLC	-0.300	(1.387)	-3.654**	(1.585)	-2.587*	(1.435)	0.660	(1.404)	0.0421	(0.126)	124	0.537
Austria	CA Immobilien Anlagen AG	0.791	(1.043)	4.944***	(1.171)	0.440	(1.074)	-1.767*	(1.054)	-0.0876	(0.0945)	124	0.560
United Kingdom	Capital & Counties Properties PLC	0.494	(1.303)	-6.909***	(1.493)	-6.372***	(1.348)	2.709**	(1.319)	-0.175	(0.118)	124	0.780
Belgium	Cofinimmo SA	0.275	(0.639)	2.734***	(0.718)	1.803***	(0.658)	-0.242	(0.646)	0.0646	(0.0580)	124	0.717
France	Covivio SA	-0.226	(0.678)	5.063***	(0.762)	2.177***	(0.698)	-0.467	(0.685)	0.0136	(0.0615)	124	0.818
Germany	Deutsche Euroshop AG	-0.0831	(0.720)	3.961***	(0.823)	1.068	(0.745)	0.0576	(0.729)	0.0314	(0.0652)	124	0.713
Germany	DIC Asset AG	-0.329	(1.064)	8.154***	(1.227)	2.579**	(1.103)	-0.992	(1.078)	-0.0993	(0.0964)	124	0.590
United Kingdom	Daejan Holdings PLC	1.360	(1.163)	-3.257**	(1.339)	-13.74***	(1.206)	12.51***	(1.178)	-0.129	(0.105)	124	0.750
United Kingdom	Derwent London PLC	-0.294	(0.860)	-15.09***	(0.981)	-7.960***	(0.889)	3.309***	(0.870)	-0.0620	(0.0779)	124	0.918
Germany	Deutsche Wohnen SE	-0.316	(0.966)	8.279***	(1.096)	5.725***	(0.997)	-0.854	(0.977)	0.105	(0.0875)	124	0.611
Norway	Entra ASA	-1.044	(1.247)	1.156	(1.388)	0.169	(1.281)	1.328	(1.258)	0.110	(0.113)	124	0.246
France	Gecina SA	0.143	(0.764)	1.794**	(0.864)	-0.610	(0.788)	1.330*	(0.772)	0.115*	(0.0692)	124	0.743
United Kingdom	Grainger PLC	1.657	(1.078)	-8.659***	(1.237)	-4.604***	(1.116)	1.739	(1.091)	-1.96e-05	(0.0976)	124	0.757
Germany	Hamborner Reit AG	0.272	(1.019)	4.818***	(1.170)	1.734	(1.056)	-0.150	(1.032)	0.0305	(0.0924)	124	0.448
United Kingdom	Helical PLC	2.045	(1.356)	-12.41***	(1.551)	-9.564***	(1.403)	-3.111**	(1.373)	-0.143	(0.123)	124	0.745
United Kingdom	Hammerson PLC	0.296	(0.704)	-4.593***	(0.814)	-4.394***	(0.731)	3.089***	(0.714)	-0.0199	(0.0638)	124	0.881
United Kingdom	Hansteen Holdings PLC	0.646	(1.003)	-1.153	(1.149)	-4.360***	(1.038)	0.982	(1.015)	-0.0519	(0.0908)	124	0.516
Italy	Immobiliare Grande Distribuzione SIIQ SpA	-1.417	(1.917)	6.567***	(2.165)	1.023	(1.977)	-3.320*	(1.938)	-0.0614	(0.174)	124	0.507
United Kingdom	Intu Properties PLC	0.358	(0.922)	-3.280***	(1.059)	-3.032***	(0.955)	1.038	(0.933)	0.00752	(0.0835)	124	0.815
United Kingdom	Land Securities Group PLC	-0.289	(0.864)	-5.905***	(0.990)	-4.609***	(0.895)	5.495***	(0.875)	0.00489	(0.0783)	124	0.874

Germany	LEG Immobilien AG	-1.081	(0.995)	6.664***	(1.132)	3.089***	(1.028)	-0.557	(1.007)	0.0598	(0.0902)	124	0.614
United Kingdom	Londonmetric Property PLC	0.783	(0.772)	-3.611***	(0.884)	-7.681***	(0.799)	4.480***	(0.782)	-0.00669	(0.0700)	124	0.789
Belgium	Leasinvest Real Estate SCA	0.162	(1.522)	4.164**	(1.715)	2.710*	(1.569)	-5.863***	(1.539)	0.146	(0.138)	124	0.187
France	Mercialys SA	-0.303	(0.913)	1.798*	(1.033)	1.767*	(0.942)	0.827	(0.924)	0.0525	(0.0828)	124	0.577
Switzerland	Mobimo Holding AG	0.411	(0.611)	2.610***	(0.670)	1.622***	(0.625)	-0.775	(0.616)	0.00452	(0.0554)	124	0.525
Norway	Norwegian Property ASA	-0.0245	(1.893)	0.0438	(2.071)	1.294	(1.935)	1.986	(1.907)	-0.0983	(0.172)	124	0.092
Netherlands	NSI NV	-1.002	(1.081)	5.505***	(1.203)	-2.218**	(1.110)	0.720	(1.091)	-0.0315	(0.0980)	124	0.422
United Kingdom	Primary Health Properties PLC	1.751*	(1.034)	0.371	(1.194)	-1.161	(1.073)	0.00256	(1.048)	0.00467	(0.0936)	124	0.245
Belgium	Intervest Offices & Warehouses NV	1.826*	(0.967)	1.284	(1.091)	-1.089	(0.996)	0.782	(0.977)	0.0636	(0.0876)	124	0.317
Switzerland	PSP Swiss Property AG	0.853	(0.573)	5.975***	(0.640)	-0.0763	(0.589)	-0.210	(0.579)	0.0630	(0.0519)	124	0.703
United Kingdom	Safestore Holdings PLC	0.0979	(1.346)	-9.323***	(1.553)	-6.202***	(1.396)	0.788	(1.364)	0.103	(0.122)	124	0.631
United Kingdom	SEGRO PLC	0.116	(0.710)	-4.281***	(0.810)	-2.916***	(0.734)	4.710***	(0.718)	0.0275	(0.0643)	124	0.855
United Kingdom	Shaftesbury PLC	0.198	(0.718)	-1.323	(0.830)	-4.623***	(0.746)	0.976	(0.728)	0.0282	(0.0651)	124	0.759
Netherlands	Eurocommercial Properties NV	-0.882	(0.872)	1.758*	(0.980)	1.283	(0.898)	0.660	(0.881)	-0.0223	(0.0790)	124	0.692
Switzerland	Swiss Prime Site AG	-0.298	(0.604)	5.136***	(0.679)	2.007***	(0.622)	-0.462	(0.611)	0.105*	(0.0548)	124	0.659
Germany	TAG Immobilien AG	0.205	(1.250)	5.369***	(1.430)	2.750**	(1.293)	-0.0298	(1.265)	0.0481	(0.113)	124	0.513
Germany	TLG Immobilien AG	-1.081	(1.025)	5.295***	(1.179)	0.0890	(1.062)	-0.296	(1.039)	0.111	(0.0929)	124	0.542
Netherlands	WFD Unibail Rodamco NV	0.373	(0.665)	2.885***	(0.761)	2.414***	(0.688)	-1.703**	(0.673)	0.0239	(0.0603)	124	0.817
United Kingdom	Unite Group PLC	0.182	(0.990)	0.570	(1.128)	-3.998***	(1.023)	0.512	(1.002)	-0.0200	(0.0897)	124	0.658
Netherlands	Vastned Retail NV	-0.924	(0.963)	3.063***	(1.084)	1.816*	(0.992)	-0.951	(0.973)	-0.0724	(0.0873)	124	0.613
Germany	Vonovia SE	-1.417	(0.902)	9.399***	(1.036)	7.513***	(0.935)	-3.880***	(0.914)	0.0904	(0.0817)	124	0.731
Belgium	Warehouses de Pauw Comm VA	-0.0334	(1.036)	4.583***	(1.158)	3.961***	(1.065)	-0.997	(1.046)	0.0376	(0.0939)	124	0.609
Netherlands	Wereldhave NV	0.546	(0.786)	1.652*	(0.892)	0.567	(0.811)	-1.028	(0.795)	-0.146**	(0.0712)	124	0.736
Belgium	Wereldhave Belgium Comm VA	-0.662	(1.424)	1.944	(1.612)	2.384	(1.469)	0.402	(1.440)	0.0336	(0.129)	124	0.262
United Kingdom	Workspace Group PLC	2.754*	(1.493)	-7.089***	(1.716)	-10.52***	(1.547)	1.316	(1.513)	-0.131	(0.135)	124	0.710

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Equation (1) Regression Output – Local Index (Germany – DAX index)

Country of Incorporation	Company name	Pre-event (t =-1)	SE	Event (t = 0)	SE	Post-event (t =1)	SE	Post-event (t =2)	SE	Constant	SE	Obs.	R-squared
Germany	Adler Real Estate AG	-0.329	(1.944)	5.452**	(2.307)	2.827	(2.040)	-2.048	(1.977)	-0.158	(0.176)	124	0.189
	alstria office REIT AG	0.0925	(0.769)	6.124***	(0.913)	1.037	(0.807)	-0.309	(0.782)	-0.00254	(0.0697)	124	0.665
	Deutsche Euroshop AG	-0.0398	(0.721)	3.684***	(0.855)	0.915	(0.757)	0.147	(0.733)	0.0314	(0.0653)	124	0.714
	DIC Asset AG	-0.263	(1.074)	8.150***	(1.275)	2.567**	(1.127)	-1.008	(1.093)	-0.104	(0.0973)	124	0.583
	Deutsche Wohnen SE	-0.406	(0.962)	7.400***	(1.142)	5.217***	(1.010)	-0.514	(0.979)	0.121	(0.0872)	124	0.619
	Hamborner Reit AG	0.422	(1.008)	4.899***	(1.196)	1.853*	(1.058)	-0.215	(1.025)	0.0191	(0.0913)	124	0.462
	LEG Immobilien AG	-1.179	(1.017)	6.239***	(1.207)	2.868***	(1.067)	-0.379	(1.034)	0.0720	(0.0921)	124	0.600
	TAG Immobilien AG	0.181	(1.252)	5.862***	(1.485)	2.997**	(1.313)	-0.203	(1.273)	0.0441	(0.113)	124	0.515
	TLG Immobilien AG	-1.116	(1.038)	5.370***	(1.232)	0.164	(1.089)	-0.313	(1.056)	0.113	(0.0940)	124	0.533
	Vonovia SE	-1.557*	(0.909)	9.231***	(1.078)	7.396***	(0.954)	-3.785***	(0.924)	0.103	(0.0823)	124	0.728

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

APPENDIX II

Figure 1- Geographical allocation of direct real estate investment (Austria)

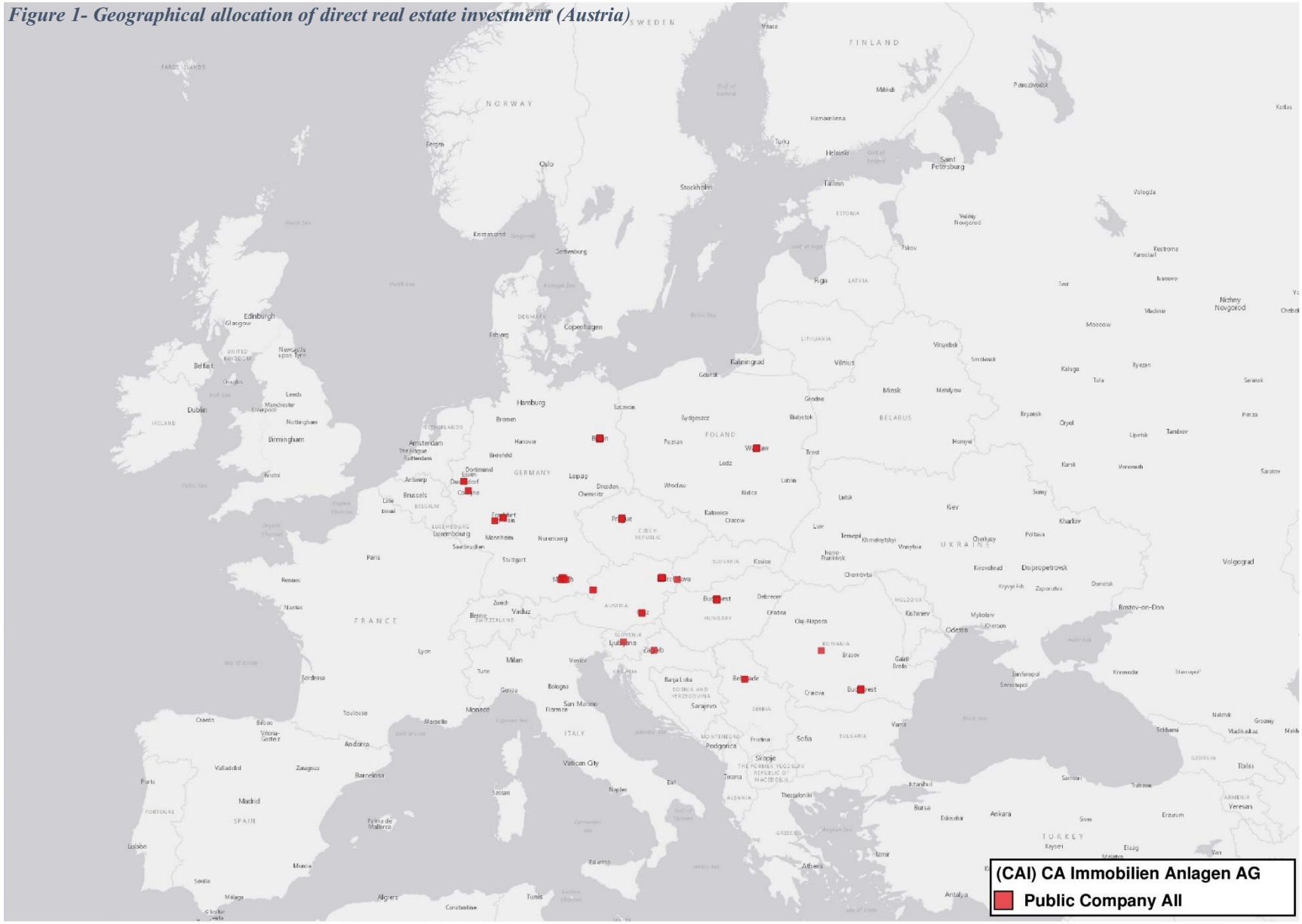


Figure 2 Geographical allocation of direct real estate investment (Belgium)

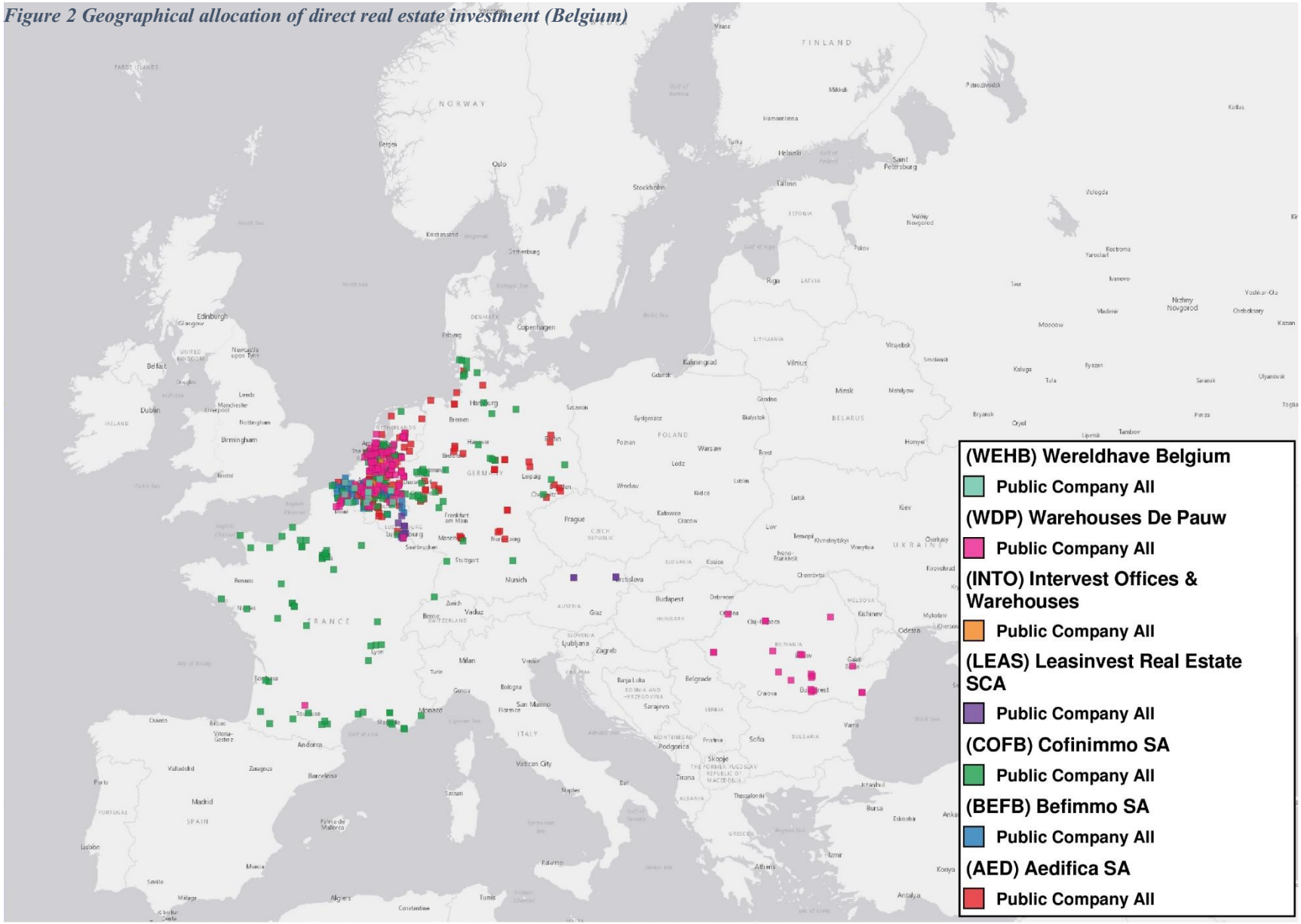


Figure 3 Geographical allocation of direct real estate investment (France)

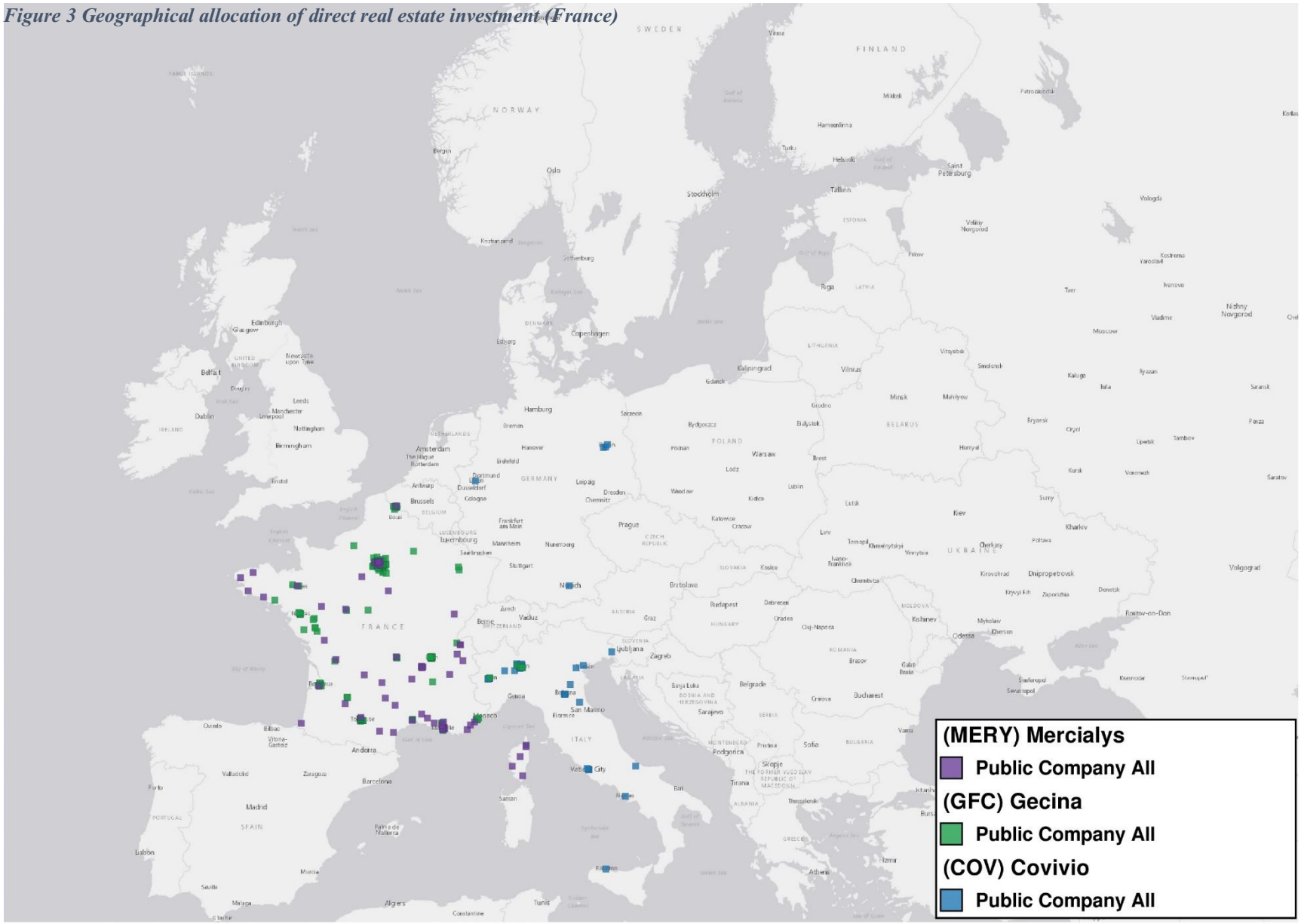


Figure 4 Geographical allocation of direct real estate investment (Germany)

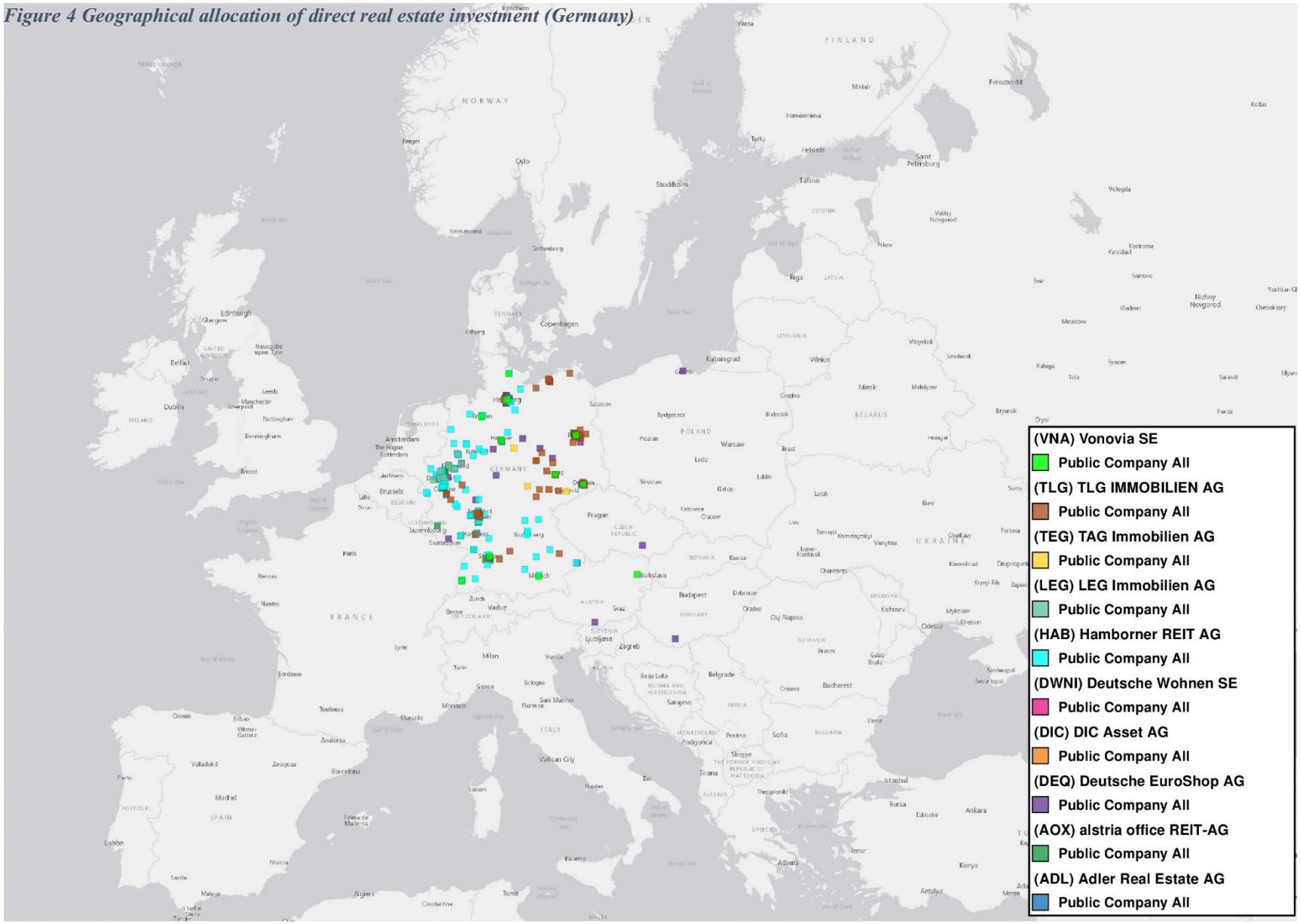


Figure 5 Geographical allocation of direct real estate investment (Italy)

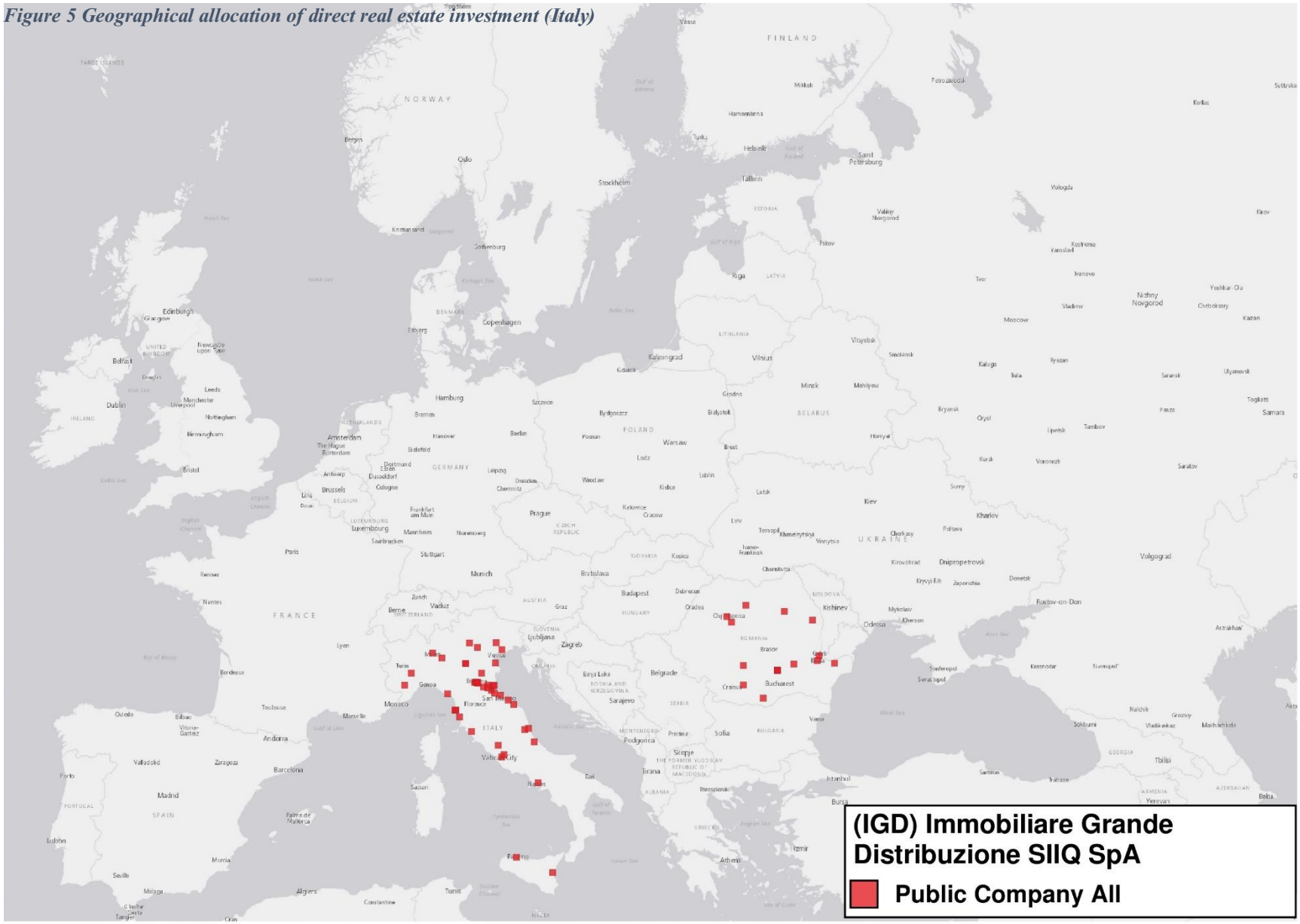


Figure 6 Geographical allocation of direct real estate investment (Netherlands)

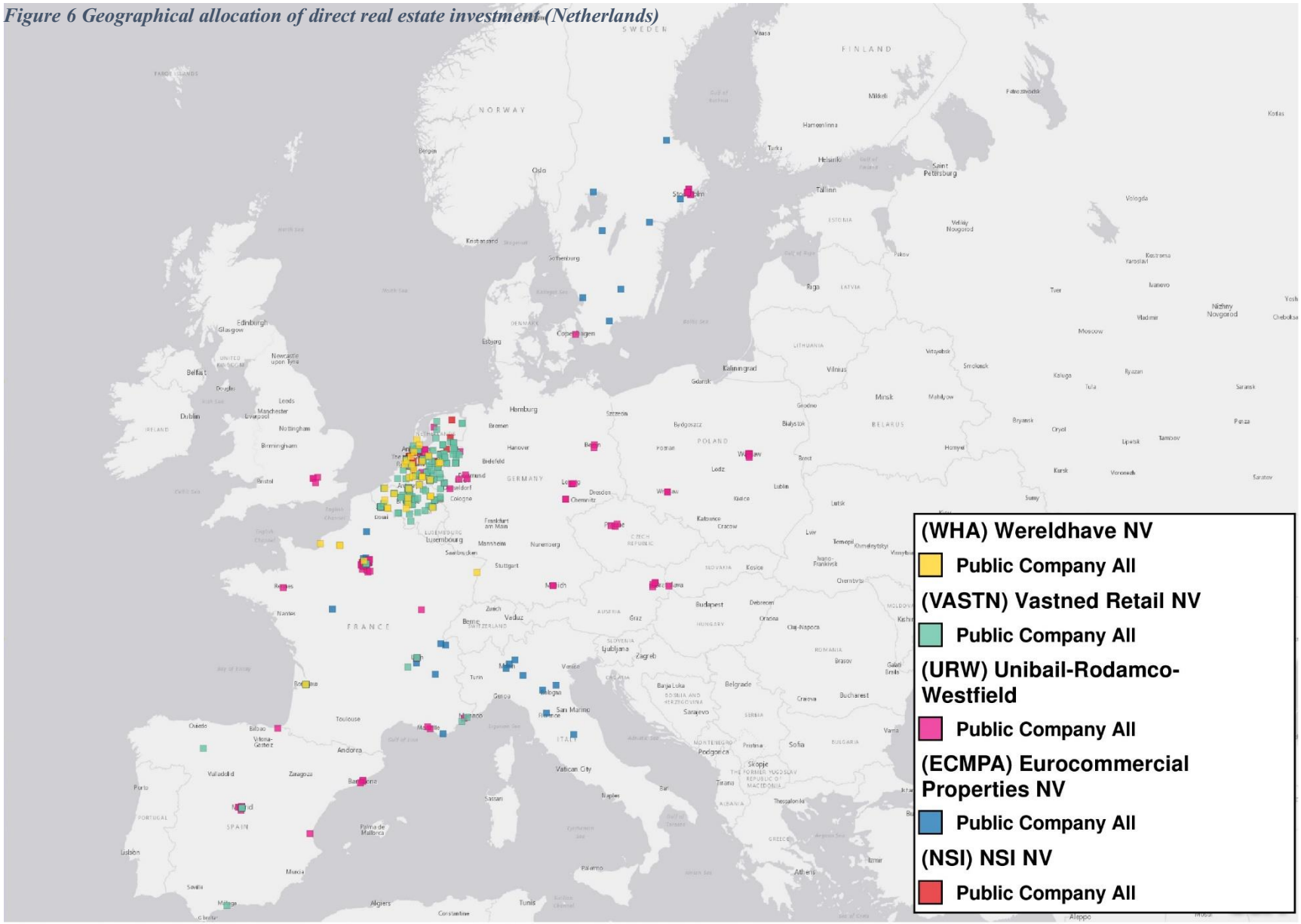


Figure 7 Geographical allocation of direct real estate investment (Norway)

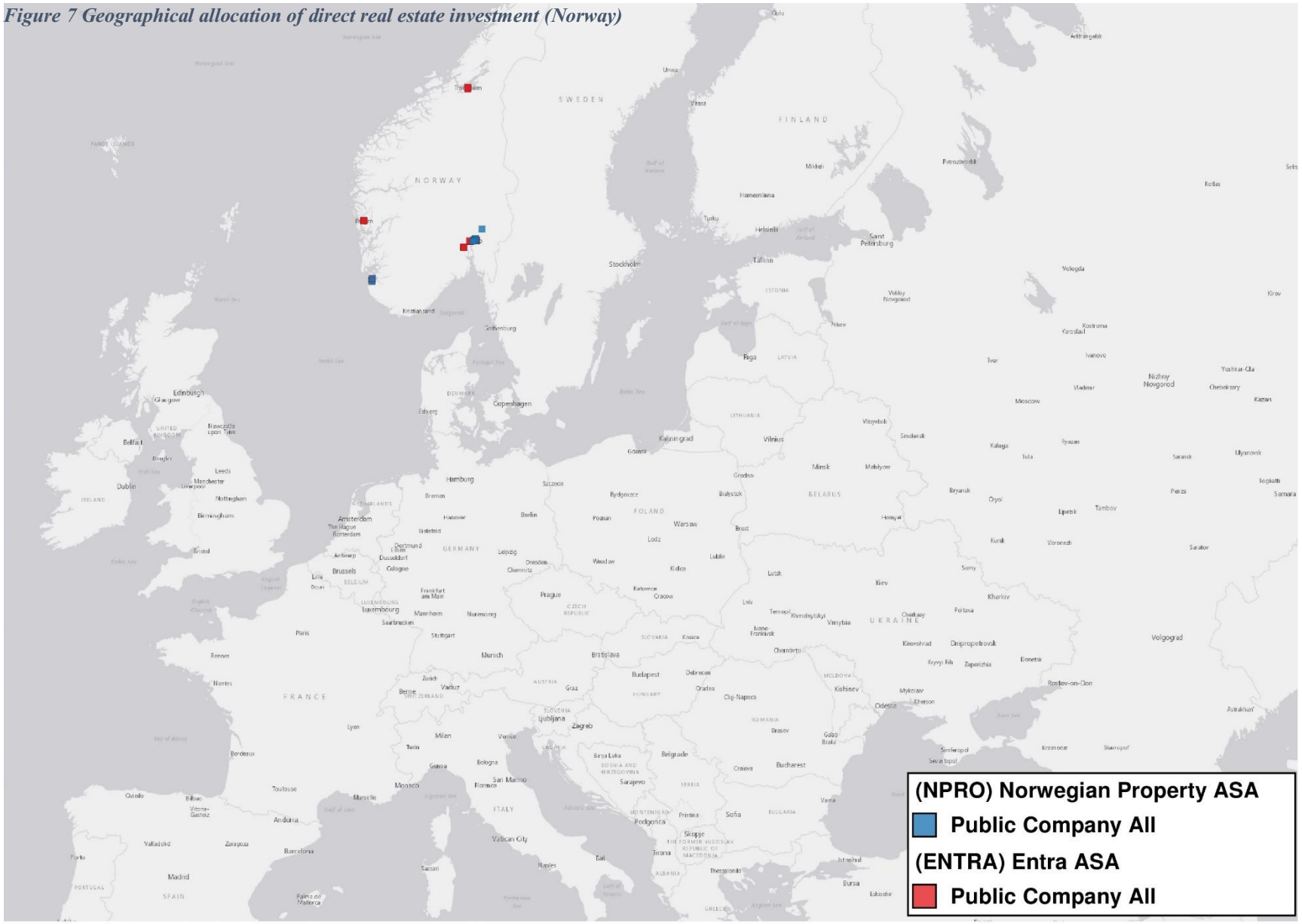


Figure 8 Geographical allocation of direct real estate investment (Switzerland)

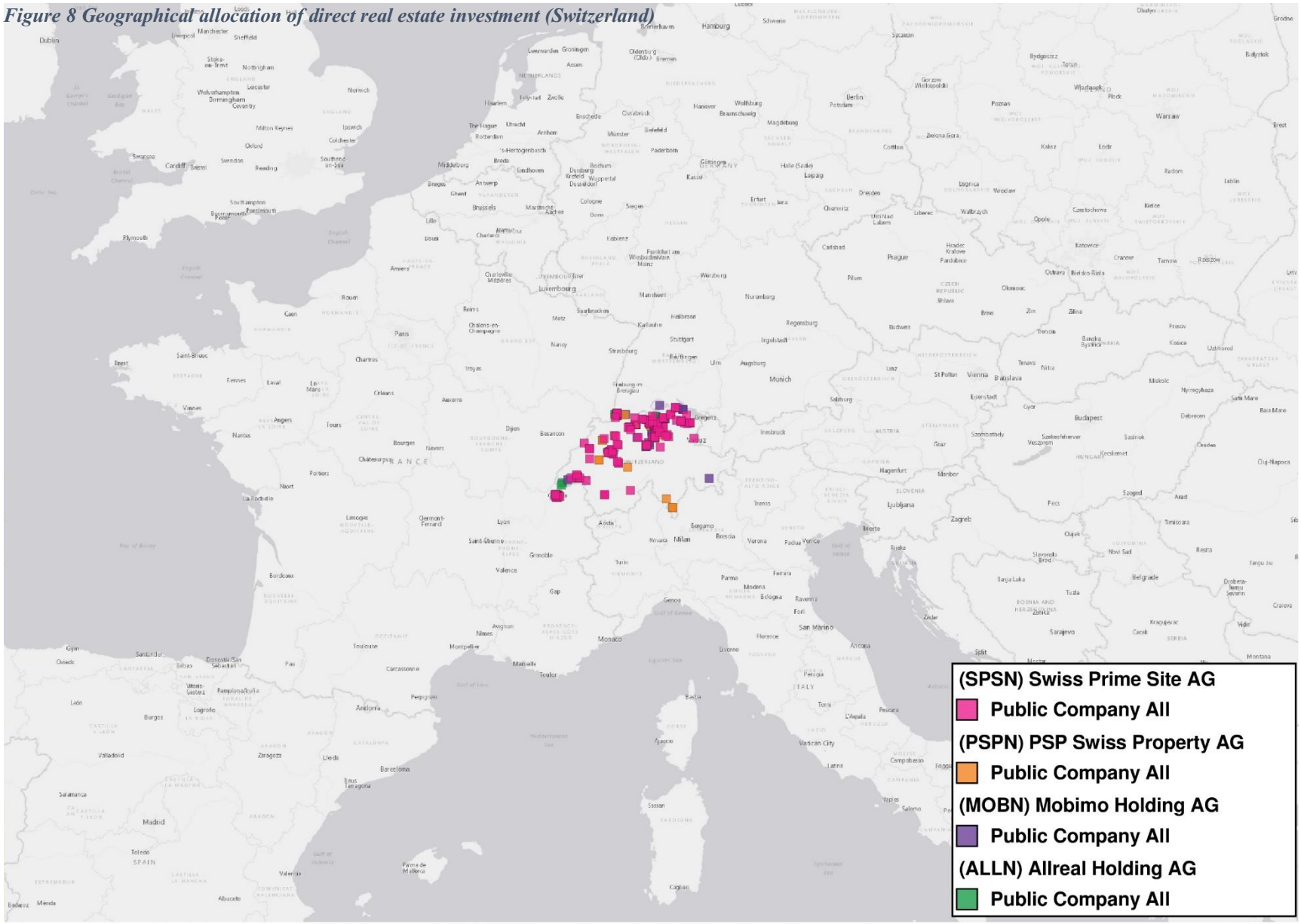
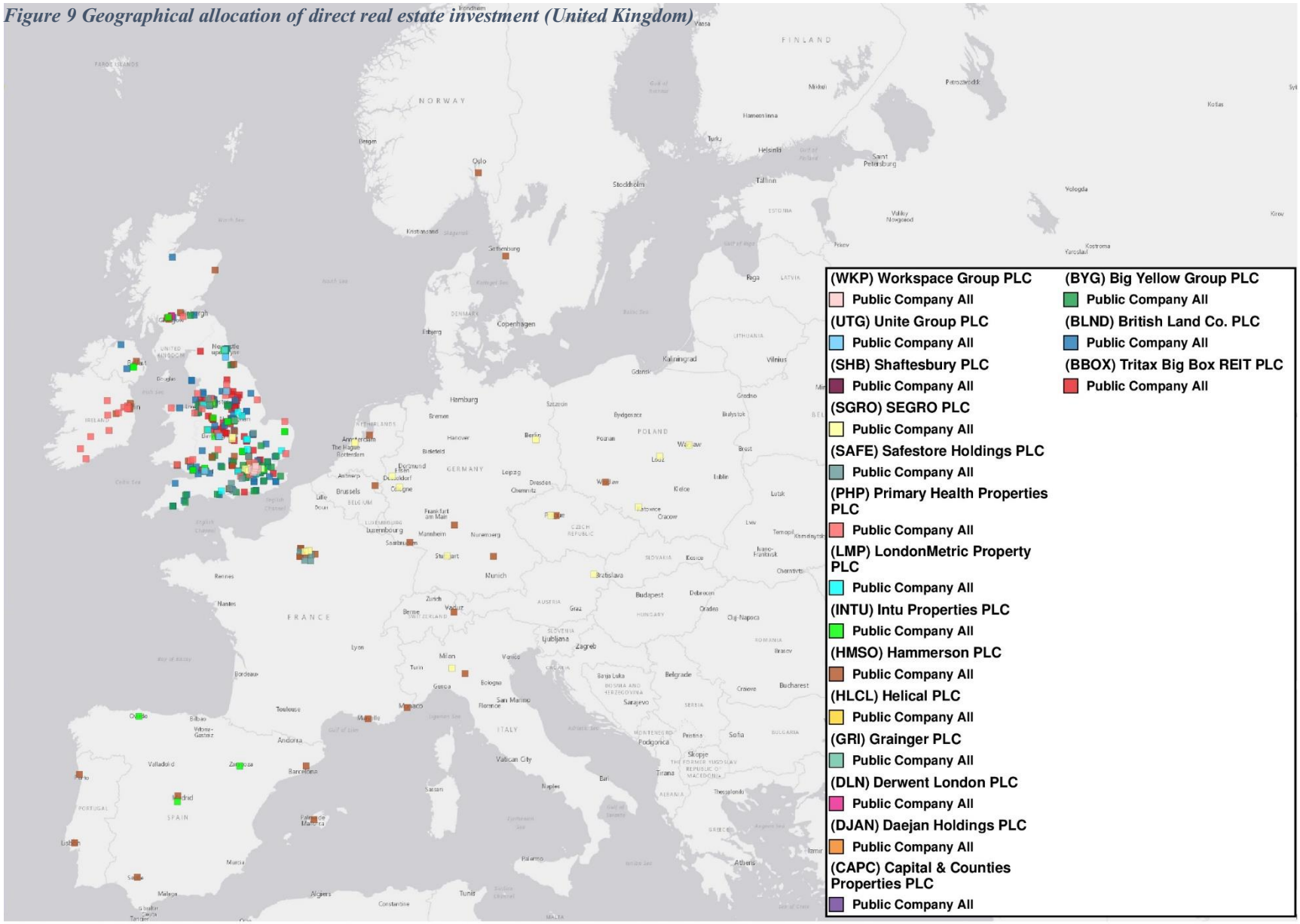


Figure 9 Geographical allocation of direct real estate investment (United Kingdom)



Equation (4) Regression Output – Excluding UK-incorporated companies

Variables	CAR
trd_int	14.95
	(12.95)
log_GDP	-4.837*
	(2.671)
Constant	55.83*
	(27.92)
Observations	33
R-squared	0.104

Standard errors in parentheses
**** p<0.01, ** p<0.05, * p<0.1*